MEDICAL LIBRARY

Paid Circulation, 28,187

BROOKHAVEN NATIONAL LABORATORY
JAN 18 1954
RESEARCH LIBRARY

The New England Journal of Medicine

FORMERLY THE BOSTON MEDICAL AND SURGICAL JOURNAL — *Established 1828*

VOLUME 250 JANUARY 7, 1954 NUMBER 1

The Teaching of Medicine and Surgery as One Discipline 1
Oliver Cope

Rehabilitation of Patients Totally Paralyzed below the Waist 4
Donald Munro

Clinical Follow-up Study of 398 Patients Suspected of Having Lung Cancer . . 14
James M. McNulty

Medical Progress: Plastic Surgery: Facial Injuries 17
Bradford Cannon and Joseph E. Murray

Massachusetts Medical Society 36

Notices 38

Medical Intelligence:

Pulmonary Embolism Complicating Trypsin Therapy 23
Bert Seligman

Doctors Afield: Wilfred Thomason Grenfell 24
Harrison E. Kennard

Case Records of the Massachusetts General Hospital 26

Editorials:

Yorkshire Practitioner 34
Alcoholic Beverages 35
Metropolitan Studies Marriage Survival 35
"CARE" Medical Help to India 36

Massachusetts Department of Public Health 37

Entered as second-class matter, November 16, 1932, at the post office at Boston, Massachusetts, under the Act of March 3, 1879.
Published weekly at 8 Fenway, Boston 15. Domestic, $8.00 per year.

New! 1954 Current Therapy

Ready February 20th — presenting the best treatment available today for every disease you're likely to encounter! This is not a collection of "recent advances," nor is the material taken from current literature. It *is* a complete reference on exact methods of treatment actually being used in practice by 384 American authorities. 1954 CURRENT THERAPY gives you more than 100 new treatments — different and better in some way than the best treatments known last year for the same disease. Some of these are: Cortisone in bronchiectasis; Aureomycin for acute viral pericarditis; Management of Pyroxidine (B_6) deficiency in children; Hydrocortisone ointment in contact dermatitis and Camoquin in malaria.

By 384 American Authorities selected by a Board of Consultants. Edited by HOWARD F. CONN, M.D. 960 pages, 8" x 11". $11.00. *Ready February 20th.*

W. B. Saunders COMPANY
WEST WASHINGTON SQUARE, PHILADELPHIA 5

7105-47-16

SURITAL® SODIUM

The New England
Journal of Medicine

Copyright, 1954, by the Massachusetts Medical Society

Volume 250 JANUARY 7, 1954 Number 1

THE TEACHING OF MEDICINE AND SURGERY AS ONE DISCIPLINE*

OLIVER COPE, M.D.†

BOSTON

THE rapid expansion of medical knowledge, the lengthening period of medical education and the current emphasis on specialization both in teaching and in practice demand scrutiny of the concepts on which the present undergraduate medical curriculum is founded. Medical knowledge has been expanding rapidly, and teachers have met the expansion by adding unceasingly to the length of the curriculum. A hundred years ago formal medical education was encompassed in one academic year. Today, with the many branches of science and the spread of the departmental system of teaching, as many as fourteen years are absorbed by the educational program of the university and graduate training hospital (Fig. 1).

Further advances in medical knowledge are to be anticipated. Some mechanism must be found to meet these advances other than mere lengthening of the curriculum. If none is found, half the student's life will soon be caught in the web of formal academic learning, with little time left for the responsible, mature life of medical practice. One such mechanism might be the dissolution of departmental barriers. The departmental structure of present-day medical schools tends to freeze the medical curriculum in a rigid pattern. To meet the advances in medicine a more flexible pattern is needed. There would be greater flexibility if there were fewer departments. Moreover, the lines drawn between a number of departments are artificial, and there is a wasteful overlap and duplication.

If one is to consider dissolving any departmental barrier it would be only logical to deal first with that between the two largest clinical departments, internal medicine and general surgery, which account for the major portion of time in the clinical years of undergraduate medical education. If medical education is to be made more efficient, if time is to be saved in the curriculum, attention should first be given to these two.

In addition to efficiency in teaching, a possible argument for the consolidation of the teaching of these two departments is that it might be good for both subjects.

When the question of consolidation of departments is examined, two insidious influences are to

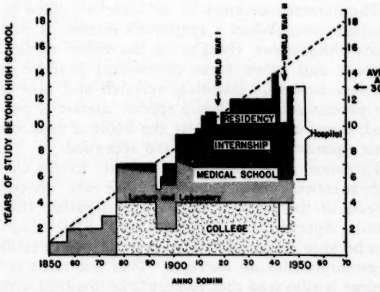

FIGURE 1. *Development of the Formal Educational Program of the Surgeon at Harvard Medical School and the Massachusetts General Hospital over the Past Hundred Years.* (*Reproduced from* The Hospital in Contemporary Life [*Edited by N. W. Faxon. 288 pp. Cambridge: Harvard University Press, 1949*], *with the Permission of the Publishers.*)

In 1853 the medical school extended its curriculum from one to two years; no previous college study was required. Decade by decade the curriculum was gradually lengthened. Years of college, medical-school, internship and residency training were added so that by 1941 the curriculum had reached fourteen years after graduation from high school. If the line of growth over these years is projected to 1970 the length of the curriculum will be eighteen years after high school. Comparable histories are found in other medical-school and hospital programs and if years as research and clinical fellows are included, medical programs have been as long as the surgical.

be kept in mind, a disproportionate emphasis that each department places on its own field and the current stress on specialization. It is only human that each member of a specialty should think that his own knowledge is of particular importance to the education of the medical student. It is therefore commonplace that each department is dissatisfied with the student's knowledge at the time of his graduation; each department desires a larger share

*Read by invitation at the First World Conference on Medical Education, London, August 27, 1953.
From the Department of Surgery, Harvard Medical School, and Massachusetts General Hospital.

†Associate professor of surgery, Harvard Medical School; visiting surgeon, Massachusetts General Hospital.

of the curriculum. Certainly, the last thing any teacher or department will want to do is to give up time. Any move for a consolidation is therefore likely to engender strong emotional opposition.

At present there is a helter-skelter trend toward specialization in medicine. This specialization applies to medical teaching and research as well as practice. In a field of knowledge as vast as that of medicine some specialization is inevitable, and some is sound. It is inevitable because no one mind can encompass the entire field of medicine; it is sound because good teaching, research and medical care demand deep knowledge. It is unsound, however, when the specialization becomes so narrow that the teacher or physician no longer appreciates how his special body of knowledge relates to the whole of medicine.

There is a harmony to medicine. Each field of medical science, each area of practice, contributes to the teaching of medicine. These various areas must not isolate themselves, for each gains strength from the others.

The harmony or unity of medicine is broken by specialization. When a specialist's interest is pursued without due thought of the other medical sciences and other areas of medical practice it becomes isolated. Teaching, research and care of the patient suffer. When a special interest is pursued, therefore, its relation to the whole of medicine must constantly be reviewed and appraised.

Furthermore, education, in contrast to research and practice, deals primarily with the general aspects of the subject, with concepts rather than details. Specialization is out of step in basic education because it is concerned with details, and details in profusion obscure concepts. It is not until the student is advanced that he should be involved with specialization.

Thus, undergraduate medical education should deal primarily with the concepts of general fields. A special field should be explored only as an example of a point of view, and of the ways and benefits of research. The undergraduate years cannot hope to cover the points of view, technics or knowledge of all the special fields of medical science and practice, and the specialist who limits his teaching to his special field of interest is a discordant teacher of the undergraduate phase of medical education. These principles apply to all teachers, including the biochemist, the bacteriologist, the internist and the surgeon.

Should medicine and surgery continue to be taught in the undergraduate curriculum as two separate disciplines, or should they be combined? As the first step to an answer one must determine what medicine is, what surgery is, and what right each has to a place in the curriculum.

Internal medicine is the parent field of clinical practice. Its broad wings stretch out to include all the clinical sciences. Because of its breadth it is the diagnostic clearing house, and its therapy includes all but surgery. Specialization has been legitimized only in radiology, dermatology, neurology and psychiatry — fields of practice requiring either detailed knowledge or long years of special education. Other areas of specialization such as cardiology and gastroenterology are still held within the parent fold in most medical schools and hospitals. Because it has resisted being partitioned into narrow specialties and has continued to foster a deep concern for medical and social science, internal medicine retains the first right to the curriculum. Undisputed, it is the central core of medical education.

Surgery has been split apart from medicine because of the intricacies of the surgical method of therapy. Two divergent views are held regarding what surgery implies or encompasses. The first holds that surgery is a specialty limited to therapy. By this narrow view, inherited from the days of the barber surgeon, the surgeon is a technician who does the bidding of the internist. He is not concerned either with the diagnosis or the consequences of his act. In the old days the barber surgeon departed for another town after an operation or two, leaving the care of his patient to God and the family. Today such a surgeon departs from the hospital immediately on completion of the operation and leaves the patient to the care of the internist. This concept of surgery, though it may train dexterous technicians, fails to take into account what the surgeon may learn about disease along the way. In terms of medical progress it is profligate. Because it is concerned solely with technic, details of therapy belonging to graduate training, such surgery should have no rights in the undergraduate curriculum.

The other view of surgery holds that the surgeon starts with the same basic attitude and relation to the patient as the internist, from whom he differs only in that he has learned the surgical mode of therapy. He has an understanding of medical and psychologic therapies and knows when they are indicated.

This view takes advantage of the intimate contact that the surgeon has with the patient and the patient's disease — a contact that gives him facility along certain lines of diagnosis and inevitably brings him a greater experience with certain diseases. It means that the surgeon becomes better acquainted than his internist colleagues with diseases requiring predominantly surgical treatment.

It is obvious that if the first concept of surgery prevails it will not be possible to combine the teaching of medicine and surgery. If the second prevails, however, the combination should be simple, for the attitude of internist and surgeon is identical.

Much might be gained if the departments of medicine and surgery were willing to combine in the teaching of undergraduate medicine. Unnecessary duplication in the teaching of many subjects could

be eliminated. A number of diseases such as those of the gastrointestinal tract and the endocrine organs are traditionally taught by both departments. Consolidation could be readily achieved and, where differences in point of view still exist, combined group teaching by internist and surgeon arranged for.

Time-honored but outmoded subjects could be cut out of the curriculum at the time of consolidation. The number of facts that a student must learn could be promptly curtailed. The internist might agree to eliminate the details of electrocardiography and dosages of certain drugs if the surgeon would forbear from teaching the technical details of operations. There is no place in the undergraduate medical curriculum for such details of practice. They belong in the graduate years.

A combined teaching program should facilitate the screening and introduction of new concepts. The development of the understanding and the teaching of psychologic medicine, a pressing yet perplexing problem confronting medical education and practice, should move faster and more securely if surgeon and internist shared the responsibility of collaborating with the psychiatrist.

Joining forces in the teaching of undergraduate medicine should revivify both internal medicine and surgery. It is inevitable that any field that has held the center of the stage in medical education as long as internal medicine has should have developed some smugness and complacency. If the surgeon is to give up the teaching of technical aspects of operations, a subject dear to his heart, the internist, I am sure, will be willing to have a good look at his pet subjects and his attitudes.

The union would be good for surgery. It would force the surgeon to be concerned with the functional aspects of the diseases he treats and keep him from being overly concerned with the technical aspects. The surgeon tends to be preoccupied with anatomy and technic. He forgets that the advances of surgery in recent years have come from the application of the knowledge of function to his care of disease rather than to any new instrument or way of making an incision. In this appreciation of function the surgeon has been a generation behind medicine. It is easy to conjecture that the advances of the future, again, will not lie in new technics but in the adaptations of medical science.

The difficulties of such a combination will be largely emotional. The internist will not want to be bothered with his technically minded colleague, the surgeon. The surgeon, traditionally considered intellectually inferior by the internist, will be anxious, ready to have his feelings hurt and assertive, therefore, from the start. But still it is worth the try.

Disadvantages are to be mentioned. Union in teaching might curtail the expression of different points of view. In unsettled areas of medicine it is important for the student to hear different attitudes and even controversy, for controversy exists in medicine only where understanding is incomplete. If a subject about which all is not known is taught from only one point of view, the student too readily gets the impression that all is known.

Many people do their best work when they are responsible to themselves and not to others. Consolidating too many in one department might tend to limit the initiative of some. By wise planning both these disadvantages could be obviated.

There is a danger to surgery in such a union. The practice of caring for both medical and surgical patients on the same ward might grow, and the surgeon in his preoccupation with the actual surgical maneuvers would inevitably be tempted to leave both the preoperative and postoperative care of his patients to his internist colleague. A surgical ward, distinct from the medical, demands more of the surgeon. If the responsibility is placed upon him he will be a better teacher.

I have gladly acceded to the request that I discuss this subject because the concept of joining medicine and surgery into a single teaching discipline affords an opportunity to illustrate a number of the troubles of present-day medical education. One can read between the lines that I think much might be gained by the amalgamation, but all will admit that it will be difficult and slow of accomplishment. From the practical point of view — and one must be practical and not content with pious platitudes — there are prior steps to be taken. Surgery and medicine should each put its house in order.

Before taking up the practical steps I should like to make an illustration. Medical education, and medical practice, may be visualized as being carried along by a wheel. The various medical sciences and areas of medical practice are spokes of the wheel. Each spoke in turn and at the appropriate moment bears the weight. The hub of the wheel, to which each spoke relates, represents the unity of medicine. If medical education is carried on too far out on a spoke — that is if education is too narrow and too specialized — it is cut off from the hub and no longer carries weight either in education or in sound practice.

Surgical specialties in their preoccupation with technic have tended to get too far out on the spoke. Otolaryngology and urology in particular give evidence of having lost contact with the hub. The other specialties too, such as gynecology and orthopedics, must be alerted to the shortcomings of the trend. It is time that they were drawn back. And newer areas of special interest, such as thoracic surgery, should not be allowed to sever their contact with the hub. The practical step is the reintegration of otolaryngology, urology, gynecology and other special surgical interests into a broad department of surgery.

Though it has resisted better than surgery, medicine has also suffered from the disintegrating force of

specialization. In addition to special areas of practice such as cardiology, diabetes and allergy, which have grown aloof from the parent, new ideas have sprung up in the form of a department. Social medicine and preventive medicine, concepts inherent in good medical practice and teaching, have appeared overnight in a number of medical schools as separate teaching departments. Medicine must resorb these special fields of interest.

SUMMARY

Means must be found as medical knowledge advances to avoid further lengthening of the undergraduate medical curriculum. Selection of what is to be taught is the essence of the problem. Dissolution of departmental barriers should aid wise selection.

There is much to recommend the teaching of medicine and surgery as a single discipline. Basically, their points of view should be the same. Each could benefit by closer association. Medical education would gain perspective. The technical therapeutic details of the moment, inappropriate to the undergraduate phase of medical education, could more easily be eliminated, and time saved for the teaching of concepts.

Experiments in teaching medicine and surgery as a single discipline are to be fostered in schools daring enough to try them. From the practical point of view the first steps in consolidation are the regathering and reorientation of the isolated specialties of both medicine and surgery.

The vested interests of the medical and surgical specialists should not deter the profession from giving these suggestions due consideration and experimentation.

THE REHABILITATION OF PATIENTS TOTALLY PARALYZED BELOW THE WAIST, WITH SPECIAL REFERENCE TO MAKING THEM AMBULATORY AND CAPABLE OF EARNING THEIR OWN LIVING*

V. An End-Result Study of 445 Cases

DONALD MUNRO, M.D.†

BOSTON

END-result figures on patients that have been paralyzed as the result of an injury to the spinal cord or cauda equina are, as far as I know, not presently available. There is a general impression, however, that prior to the onset of the Second World War the mortality among this group of patients was high, invalidism was extreme, and any rehabilitation was purely fortuitous. Recently, the general outlook has become more optimistic. There is a vague belief that possibly some of them can be rehabilitated and their invalidism diminished. This is usually qualified, however, by the statement that, of course, such good fortune is reserved for the analogous veterans of the armed services. Unfortunately, this last qualification is, for the most part, true. Virtually no American community has set up an adequate program for this group of its civilian patients, mostly, I believe, because the citizens do not feel that it has been demonstrated to be worth while.

This paper is presented, primarily, to disprove this pessimistic point of view. The patients on whom the work was done and whose end results are reported herewith were all seen and treated in the Neurosurgical Department of the Boston City Hospital. With the exception of 15 veterans, they were all the victims of "civilian accidents" and at the time of the follow-up survey were living and working as civilians in their various communities.

The survey was carried out by mail plus a few personal interviews, and the patients themselves have provided the information without prompting, by means of a questionnaire. Those who could not be reached by either mail or telephone have been classified in accordance with an earlier unpublished survey or, in the absence of that information, in accordance with their condition at the time of their discharge from the hospital.

MATERIAL

The material is made up of 445 patients who entered the hospital for treatment as the result of an injury to the spinal cord or cauda equina. In the group are included 16 epidural spinal abscesses and 3 congenital bony deformities. In the former, the cord or cauda was not directly involved in the infection, the damage having been done by the mechanical compressive effect of the extradural abscess. In the latter, the congenital deformity gave no symptoms until an injury had been added locally.

For analysis the patients have been divided according to *severity of injury*, *segmental level of maximum damage* and *length of follow-up study*.

*Presented at the annual meeting of the New England Surgical Society, Watch Hill, Rhode Island, September 12, 1953.

†Assistant professor of neurosurgery, Harvard Medical School; associate professor of neurosurgery, Boston University School of Medicine; surgeon-in-chief, Department of Neurosurgery, Boston City Hospital.

Classification according to *segmental levels* is as follows: cervical, thoracolumbar, lumbosacral and cauda equinal. No reference is made in this classification to vertebral levels. There were 207 cervical, 114 thoracolumbar, 51 lumbosacral and 73 cauda equinal cases.

The classification according to *severity of injury* is as follows: transection of spinal cord or cauda equina, severe neural injury and minor neural injury. Patients in whom the cord or cauda was compressed in addition were not otherwise differentiated from those in whom there was no compression. No regard is paid to the presence, absence, severity or extent of any associated bone injury in this classification. A transection is held to be present when unequivocally demonstrated at operation by visualization, with or without electric stimulation, of the cord or cauda or by a sufficiently prolonged clinical course typical of that diagnosis. A serious injury is one in which the cord or cauda was not transected but in which, nevertheless, the damage was of sufficient magnitude to leave permanent, demonstrable loss of neural function as a result. Included in this group are patients with such pathology as contusion, partial transection, extensive hematorrhachis, severe compression of the cord or cauda, traumatic syrinx, atrophy and vascular deficiencies, as well as such clinical syndromes as those of a nucleus pulposus that has extruded in the mid-line from a ruptured lumbar intervertebral disk, the Brown-Séquard, the so-called "mass-reflex," and a severe lumbar hematorrhachis. Cases of uncomplicated individual radiculitis are not included.

Those patients are classed as having sustained a minor injury of the cord or cauda equina who had sufficient clinical evidence of neural damage to justify admission to the hospital as a bed patient and who showed, as a minimum, some disorganization of bladder function by symptoms, signs and cystometry. Cases of uncomplicated individual radiculitis are not included and, in particular, the isolated radiculitis caused by a posterolateral extrusion or protrusion of a cervical or lumbar nucleus pulposus is not included. The pathology of the minor injuries was usually that of edema with or without associated fleeting compression, a mild hematomyelia or a mild lumbar hematorrhachis. In these patients there was practically never any permanent functional loss.

There were 145 transections, of which 54 were cervical, 71 thoracolumbar, 19 lumbosacral and 1 cauda equinal. The severe injuries were grouped as follows: 134 cervical, 42 thoracolumbar, 32 lumbosacral, and 65 caudal, the total being 274. Nineteen cervical, 1 thoracolumbar, 0 lumbosacral, and 7 cauda equinal injuries were classed as mild, giving a total in this subgroup of 27.

The *length of follow-up* study varied from a few hours to over twenty years. It was figured in every case from the time of the receipt of the injury. It was arbitrarily divided into three groups — patients who did not live to leave the hospital, those who left the hospital but who could be followed up only to eighteen months or less and those who had been followed for eighteen months or over. Eighteen months was chosen as an arbitrary dividing line because it has been my experience that serious complications or death as the direct result of the injury is usually manifested within this period.

There were 89 patients whose follow-up study was less than eighteen months and more than one month. Twelve, or 13 per cent, of these died during that period. On the other hand, there were 240 patients who were followed for eighteen months to twenty-five years; 12.5 per cent of this group died. The average length of follow-up study in the larger group was eight years, with a low of eighteen months and a high of twenty-five years. One hundred and twelve were followed for five years or less, 81 for five to ten years, 33 for ten to fifteen years, 9 for sixteen to twenty years, and 6 for twenty-one through twenty-five years.

The difference in case content in the long-term and short-term groups was not significant. Transections made up 32 and 21 per cent, serious injuries 59 and 74 per cent and minimal injuries 9 and 5 per cent respectively.

Age and Sex Data

The age and sex data on 405 patients are given in Table 1. This material was not available in 40 others.

Mortality

Before patients can be rehabilitated they must be kept alive. The inability of the doctor to provide this latter service, except by chance, for these patients before 1940 was probably the chief reason for the lack of effort made by the profession and communities alike to rescue and much more to rehabilitate them. The pessimistic point of view that, even now, it is not worth while to save their lives because of the impossibility of making anything out of these patients later is still widely held but is no longer justified by the facts and particularly when all possible available knowledge has been made full use of.

The over-all total mortality in the entire group of 445 patients, counting death from any cause, is 34 per cent. If 25 deaths caused by diseases in no way connected with the injury are excluded, the over-all mortality is reduced to 28 per cent. This figure is virtually hospital mortality because in the earlier years no patients lived to leave the hospital and, in the later years, those who did not die in the hospital died later of some intercurrent disease not connected with the injury.

The patients in this series have all been cared for during the twenty-three and a half years from January, 1930, to July, 1953. It has proved informa-

tive to consider the comparable hospital mortality rates in the first and last periods of that time. The first period — from 1930 to 1940 — had a rate of 47 per cent. This was close to, although probably less than, the over-all rate for this condition throughout the country up to 1945 or so, since when it has probably improved an unknown amount. In comparison, the analogous rate in the last three and a half years was 20 per cent. The difference is too striking to be ignored, particularly since the types of cases involved are essentially the same. ohis reduction in mortality is the direct result of m re effective therapy. For example: in the *first ten years* all the 15 patients with cervical-cord transections and 15 of the 20 with thoracic-cord transections died; in the *last three and a half years*, however, 5 of the 10 patients with cervical transections and 8 of the 10 with thoracic transections survived.

It is this improved therapy that is still usually not available in large numbers of these invalids. For it to be available and effective requires community interest and co-operation, enthusiasm and knowledge on the part of the local medical profession and, most important of all, education of the public so that they, as individual patients, will insist on their right to these essentials. The 27 additional lives that will be saved out of every 100 such injuries justify the effort.

TABLE 1. *Age and Sex Data in 405 Patients.*

DECADE	SEX	TOTAL NO. OF CASES	CERVICAL CASES			THORACOLUMBAR CASES		
			DEATHS IN HOSPITAL	OTHER PATIENTS LIVING & DEAD	TOTALS	DEATHS IN HOSPITAL	OTHER PATIENTS LIVING & DEAD	TOTALS
First (1-10)	M	1			0	0	1	1
	F	0			0			0
Second (10-20)	M	20	8	3	11	4	1	5
	F	3			0	0	3	3
Third (20-30)	M	49	5	16	21	2	12	14
	F	13	0	1	1	1	6	7
Fourth (30-40)	M	56	5	14	19	2	17	19
	F	19	2	1	3	0	9	9
Fifth (40-50)	M	70	13	17	30	4	7	11
	F	17	1	3	4	0	6	6
Sixth (50-60)	M	55	6	20	26	6	8	14
	F	13	0	4	4	0	2	2
Seventh (60-70)	M	54	16	20	36	5	4	9
	F	9	3	3	6	1	1	2
Eighth (70-90)	M	20	6	5	11	1	4	5
	F	6	3	3	6			0
All decades	M	325	59	95	154	24	54	78
	F	80	9	15	24	2	27	29

REHABILITATION

Rehabilitation as applied to patients suffering from the results of injuries to the spinal cord and cauda equina is a much abused and misunderstood term. It is not something that the surgeon, physiotherapist, or other specialist provides or that is produced by any general or special treatment. Rehabilitation is or is not within the patient himself. It is a spiritual attribute — not in the ecclesiastical sense — but rather as opposed to the physical. Without this spiritual urge within himself no patient can be truly rehabilitated, no matter what outside aid is made available to him — with it, extraordinary capacities come to light and the patient reaches a degree of accomplishment that is totally unexpected and, in many cases, almost miraculous. The measure of rehabilitation is not the accomplishment of the obviously possible but rather the accomplishment of what would ordinarily be considered as impossible. For example, a patient in this series who was deprived of voluntary motion in all his muscles except those of his diaphragm, neck, tongue and jaw has taught himself in the course of five years to write longhand, write on a typewriter and paint. He carries out these actions by manipulating a pencil, a stick or a paint brush, each of which is held in his teeth, by moving his head. These accomplishments are of relatively little practical value, but the fact that they have been accomplished represents rehabilitation of an extraordinary degree. Compare such rehabilitation with that of the paraplegic whose only loss of voluntary motion is in his legs and lower trunk, and who is content to vegetate in a wheel chair because he cannot be bothered to learn to ambulate or work, the former a skill that, if perfected as it could easily be perfected, increases his employability, enlarges his social horizon and pays him personal dividends in the form of freedom from renal and bladder stones and infection. The former contributes to his maximum capacity, to the community in which he lives; the latter is a parasite. The fact that either one or neither one may or may not be rendered financially independent by virtue of the workmen's compensation laws or the kindness of a paternal government or of charitable organizations has no bearing on the basic problem — one man *is* rehabilitated although with a minimum of practical benefit to himself and the other man

is not rehabilitated although practically his accomplishments as well as his potentialities far outweigh those of his analogue.

The function of the medical profession in this particular field of rehabilitation is, first, to put the patient to be rehabilitated in the best possible physical shape for his task. With this accomplished the doctor has then to teach the physically capable person the methods and technics of using to capacity his newly acquired physical equipment. This is a continually progressive procedure. When the doctor is through the patient takes over. It is axiomatic that the rehabilitatory process in these patients cannot be static. It must either go forward or regress. Standing still at any one point of rehabilitation is an impossibility. Lack of forward progress means regression, which has the unfortunate characteristic of snowballing.

The foundation on which rehabilitation is built has been covered in other communications.[1, 2] Included must be an early, accurate, factual diagnosis based on the pathology that is present; the elimination of uncontrollable spasm; the reduction of genitourinary-tract infection to a minimum; the maintenance of a bladder that is of normal size and capacity and that functions on a reflex or better basis; the same functional requirement for the bowel; the maintenance of full motion in all joints; the development to its maximum capacity of the shoulder-girdle, arm and hand muscles; the ability to balance in the absence of peripheral sensations; and finally continued interest and stimulation by the doctor. With this foundation laid, the patient is then ready to learn the ABC's of the technics of rehabilitation. If he has the vital spark these will come easily to him and will actually serve their intended purpose of stimulating him to even greater efforts, accomplishments and an increasing approximation to the normal life he led before his injury. The following data give some idea of how closely civilian patients with spinal paralysis can come to attaining this end.

TABLE 1 (*Concluded*).

DECADE	LUMBOSACRAL CASES			CAUDAL CASES		
	DEATHS IN HOSPITAL	OTHER PATIENTS LIVING & DEAD	TOTALS	DEATHS IN HOSPITAL	OTHER PATIENTS LIVING & DEAD	TOTALS
First (1–10)			0 0			0 0
Second (10–20)	1	1	2 0	0	2	2 0
Third (20–30)	0 0	6 5	6 5	0	8	8 0
Fourth (30–40)	1 0	9 2	10 2	0 0	8 5	8 5
Fifth (40–50)	1 0	9 4	10 4	0 0	19 3	19 3
Sixth (50–60)	0 0	1 3	1 3	0 0	14 4	14 4
Seventh (60–70)	0	2	2 0	0 0	7 1	7 1
Eighth (70–90)	1	1	2 0	0	2	2 0
All decades	4 0	29 14	33 14	0 0	60 13	60 13

Self-Care

This is the most fundamental of all rehabilitatory accomplishments. With it comes independence, self-respect, freedom from nurse and attendant care, elimination of hospitalization or institutionalization, the probability of self-support, a normal social and family life and relief from the terrific financial burdens that must otherwise be borne by the patient, his family and his community.

There were 210 patients in whom information relative to self-care was obtained. Sixty-eight had transections, 123 had a serious neural injury and 19 had a minimal neural injury. One hundred and seventy-one, or 81 per cent, have 100 per cent self-care. They are able to do everything that that implies. Ten per cent have less than 50 per cent, and 5 per cent have no self-care.

Social Life

Next in importance to the ability to care for himself is the degree of social activity that the patient manifests. Obviously, one is the offshoot of the other and both together lead to a more healthy point of view, an appreciation of the need for self-support and a progressive attitude of mind toward the patient's disabilities. Two hundred and twelve patients gave information regarding this aspect of their lives. They were asked whether they led an active social life, stayed away from home overnight and visited their friends freely. One hundred and eighty-one patients led either a fully or a partly active social life. This was 85 per cent of the group. Fifty-six of these patients had transections, and 106 had serious injuries. Sixty-one per cent were fully active, 24 per cent were partly active, and

only 7 per cent had no social activity. It is apparent from these figures, and those of the preceding section, that self-care and social activity go hand in hand. This is not surprising.

Employment

With full self-care ability and an active social life, the patient should be able and should be expected to go to work. To determine the extent of employment among the patients in this survey, they were asked to state whether they were wholly self-supporting, — this, of course, including support of their families, — whether they partially supported themselves and families or whether they did no work. Incidental to these questions, statements were solicited relative to whether they owned their own business, worked for a salary and what kind of a job they held. This information is available but not included herewith. There were 325 patients who either sent in answers to these questions or about whom the answers could be deduced. Thirty-four of this number had not sufficiently recovered from their injury, in point of time, to be expected even to consider working. With these patients excluded, the number with potential working capacity is reduced to 291. Of this group of 291, 135, or 46 per cent, were completely or partially self-supporting, 105 (36 per cent) being completely and 30 (10 per cent) partially so. One hundred and fifty-six, or 54 per cent, did no work.

The reasons why such a large number did no work are interesting. Twenty-six were too old to work, 47 could not work on account of permanent, disabling residual loss of function, and 5 were insane. That is, 78 were unable to work on account of uncorrectable disabilities that were not of their own making. Sixteen were going to school preparatory to employment, and 12 others were industrial cases or veterans who had no financial need to work — their indolence being their own choice.

Thirty-four were unco-operative and refused to make any effort at self or other employment, and in 16 other cases there was no discernible reason why the patient was not at work. The 156 classed above as not working should, therefore, be reduced to the 50 who are employable, and in need of the financial benefits accruing from gainful labor but refuse to work. This reduces the unemployable percentage from 54 to 18. This is a much more encouraging outlook than is commonly considered to be true, even though it carries with it the discouraging figure of 27 per cent who will never be employable on account of their uncorrectable physical deficiencies.

Control of the Bladder and Bowel

Control of urination is an essential part of the technic of rehabilitation. The same is true of control of the bowel. The ability to keep dry and clean at all times and to be free of unexpected soiling is a *sine qua non* of an active social life and of remunerative employment. As part of the training in self-care, every patient in this group in whom it was physically possible to do so and who would cooperate was taught to control his bladder emptying and bowel movements without the help of urinals and without the need for enemas or cathartics. In the latter instance, they were also trained to use the ordinary toilet and not to depend on the use of a bedpan or commode.

The bladder. Unfortunately, the great majority of these patients have allowed their habits of bladder training to lapse and instead have come to depend upon some form of urinal. Nevertheless, this same majority report satisfactory control without leakage of their urinary output. One hundred and ninety-nine patients answered the relevant questions. One hundred and fifty-six, or 78 per cent, report satisfactory control, 8 (4 per cent) report partial control, which, in most cases, was so reported because of uncontrolled leakage, and 35, or 18 per cent, report no control.

The reasons behind partial or no control of urination are interesting. They include effects of the injury, 20; old age, 3; mental disease, 1; urethral stricture and suprapubic drainage, 1; the need for tidal drainage or a catheter, 8; and unco-operation, 12. Thus, the 22 per cent failures is reduced to 6 per cent by the elimination of the 33 patients whose failure to acquire control is traceable only to the effects of the injury or to other inherent uncorrectable pathology. This is an entirely reasonable figure and one that more than justifies the efforts expended by all concerned in the acquisition of bladder training.

The bowel. Despite the fact that bowel training by means of setting up a conditioned reflex is much easier to learn and practice than bladder training, an even larger percentage of the patients had regressed from the trained condition that was present at their discharge and had either partial or no control at the time of this survey. Partial control was considered to be present when the patient occasionally used enemas, cathartics or digital stimulation to provide a bowel movement. No control means that enemas or digital stimulation were constantly necessary and all regularity of bowel training and bowel movement had been lost. In other words, in the latter case the conditioned bowel reflex with which these patients had left the hospital had been destroyed.

Reports about the degree of bowel control were received from 205 patients. One hundred and thirty-eight, or 67 per cent, reported complete, 37 (18 per cent) partial, and 30, or 15 per cent, no control of their bowels.

The reasons for the regression to partial or no control were as follows: effects of the injury, 26; old age, 4; too soon after the injury, 1; and unco-operation, 28. With the elimination of these 31

patients with uncorrectable lack of control that was not their own fault, the 67 patients with partial or no control are reduced to 28 and the percentage figure from 33 to 14.

Ambulation

Perhaps the most difficult to learn of all the technics of rehabilitation is ambulation. It is even more difficult to persuade the individual patient to practice and maintain that skill once he has acquired it and once he is outside the influence of his surgical mentor. Often, it requires the most eloquent reasoning to convince him that weight bearing and upright motion are the best insurances against bladder or kidney stones and hence against genito-urinary-tract infection; that social, self-care and employment opportunities are infinitely greater if ambulation is a habit and not a lost art; and that failure to pass this difficult test, and to maintain one's proficiency in it after passing it, is evidence of a certain degree of rehabilitatory regression that only too easily becomes the first step toward a return to invalidism. The lure of the comfort and lack of effort that is inherent in a wheel chair even though combined with necessary reconstruction of certain physical features of one's home, taken with the habit we all have acquired of riding in an automobile rather than walking on our two feet, is difficult for all to resist and may be impossible for some.

Three hundred and sixteen patients reported about their ambulatory ability. Ninety-two had transections — 20 cervical, 54 thoracolumbar and 18 lumbosacral. One hundred and ninety-nine had serious neural injuries, of which 86 were cervical, 31 thoracic, 27 lumbosacral, and 55 caudal. Twenty-five had minor neural injuries, 18 being cervical and 7 caudal.

Forty-seven per cent, or 147, reported that they walked normally or had no paralysis. Twenty-seven per cent, or 84, ambulated about their homes or place of business, and 85, or 27 per cent, did not ambulate at all. Fifty-six, or 18 per cent, used a wheel chair as their sole mode of locomotion — 20 having cervical, 23 thoracic, 9 lumbosacral and 4 caudal injuries. Thirty-eight (12 per cent) were bed ridden — 15 having cervical, 15 thoracic, 5 lumbosacral and 3 caudal injuries. With the duplications eliminated 95 patients either did not ambulate, used only a wheel chair or were bed ridden.

All patients who would co-operate and were physically capable of learning to do so were trained in ambulation and its associated skills before discharge from our care. It is of interest, therefore, to discover what percentage was incapable and what unwilling to learn these skills. Thirty per cent of the 316 patients were not ambulatory. If the 64 patients who were willing but physically unable to walk on account of their age or associated mental disease, because of not having been sufficiently recovered in point of time from their injury, or because of their permanent, residual disabling neural deficiencies, are eliminated, it is apparent that only 31, or 9 per cent, have failed to take advantage of the opportunities that were offered to them.

Sexual Capacity

All patients in the survey were asked whether their sexual capacity was normal, impaired or absent and, if normal, whether any children had been born to them or their spouses since their injury. As might have been predicted, the great majority paid no attention to these requests and ignored them altogether. One hundred and seventy-two, or 58 per cent, sent in no replies. On the other hand, 135 patients did report on their sexual capacity. This included both men and women. Sixty-nine, or 51 per cent, reported normal sexual activity. Among them were 1 cervical and 4 thoracic transections, 46 serious neural injuries (19 cervical, 9 thoracic, 4 lumbosacral and 14 caudal) and 18 minor neural injuries (12 cervical and 6 caudal). Twenty-two others (16 per cent) reported impaired activity. This included 1 cervical, 5 thoracic and 2 lumbosacral transections and 14 serious neural injuries (3 cervical, 1 thoracic, 3 lumbosacral and 7 caudal). Forty-four, or 32 per cent, claimed that they had no sexual activity. In this group there were 5 cervical, 12 thoracic and 6 lumbosacral transections. Twenty-one others had serious neural injuries, 4 cervical, 5 thoracic, 7 lumbosacral and 5 caudal injuries being included in this category. It is of particular interest that of 36 patients with transections (7 cervical, 21 thoracic and 8 lumbosacral) 13, or about a third, had normal or impaired sexual activity. In connection with this, it is only fair to say that in view of the conviction of the male population at large that transection of the spinal cord precludes sexual activity, it is at least to be considered that the resultant unfavorable psychologic outlook on this problem may have some deleterious effect on the accomplishment of the sexual act by the male. This cannot be measured at this time and is a problem that deserves considerable further study. It can be stated, however, that a transection of the cord at whatever level does not invariably preclude some sexual activity.

Fifteen families, considered in terms of the individual injured spouse, have had children since that injury was sustained. There were 7 injured males who begot children. One had a lumbosacral transection, and 4 had serious neural injuries (1 cervical and 3 caudal). One cervical and 1 caudal case had minor injuries. Six of the females sustained thoracic injuries, 2 being transections and the other 4 serious neural damage. Two other female patients had caudal injuries — 1 serious and 1 minor. No conclusion can be drawn from these

data except possibly some confirmation of what has long been known. This is that, no matter what the cord or cauda injury may be in a woman, it will neither prevent impregnation nor interfere with the normal delivery of a viable child. More than 23 children were born to these various families after an injury sustained by one or the other of the spouses.

Complications

It is essential that these victims have some idea of what the future holds for them in terms of late complications of their earlier injuries. To determine this, information was requested relative to the development of bladder and renal stones and infection, bedsores and spasm, along with that of any other complications, operations, loss or gain in weight and so forth. Information along these lines was received and utilized from 240 patients with injuries classified as follows: 80 cervical, 69 thoracolumbar, 37 lumbosacral and 54 caudal. Only patients who had been out of the hospital for one and a half years or more — that is, long enough to have had an opportunity to develop complications — are included in this analysis.

The group is made up exclusively of individuals who had sustained either a transection or a serious neural injury. No patient with a minor neural injury developed complications traceable to that injury. There are 77 patients with transection and 142 with serious neural injuries. Forty-two, or 55 per cent, of those with transections and 27, or 19 per cent, of the seriously injured report complications — the incidence in the entire group being 29 per cent (Table 2).

It appears that not only the type but also the level of cord injury is a factor in the incidence of later complications. Thus, in the 80 cervical and 54 caudal patients only 9 and 17 per cent respectively of the patients developed complications. On the other hand, in the 69 thoracolumbar and 37 lumbosacral cases, the percentages of complications were 46 and 57 respectively. This was despite the fact that 28 of the thoracic as opposed to 9 of the lumbosacral injuries with complications were transections whereas only 4 of the thoracolumbar as opposed to 12 of the lumbosacral in the same groups were serious neural injuries. The corresponding figures in the cervical group were 4 transections and 3 serious injuries and in the caudal group 1 transection and 8 serious injuries.

It is apparent (Table 3) that so far as the pathology of the complications goes the greatest sources of trouble are genitourinary-tract stones associated, of course, with infection, infection of the bladder and bedsores uncomplicated by spasm. With proper understanding and co-operation on the part of the patient, these complications are all preventable.

The miscellaneous complications varied. In the cervical group, the greatest problem was the

Table 2. *Complications Occurring One and a Half Years or More after Injury.*

Type of Injury	All Cases	Complications				
		Transection	Serious Injury	Minimal Injury	Totals	Percentage
Cervical	80	4	3	0	7	9
Thoracic	69	28	4	0	32	46
Lumbosacral	37	9	12	0	21	57
Caudal	54	1	8	0	9	17
Totals	240	42	27	0	69	29
All cases	240	77	142	21	240	
Percentage of complications		55	19	0	29	

Table 3. *Late Complications of Injury.*

Type of Injury	Genitourinary-Tract Infections			Epididymitis	Spasm		Bedsore	Miscellaneous
	Entire Tract	With Stone	Bladder Only		Alone	With Bedsore		
Cervical:								
Transection	0	0	3	0	1	0	0	1
Serious	0	0	0	1	0	0	0	2
Thoracolumbar:								
Transection	3	7	7	3	3	5	13	10
Serious	0	1	2	0	2	1	0	0
Lumbosacral:								
Transection	0	2	2	1	0	0	5	2
Serious	0	2	5	1	2	2	4	6
Caudal:								
Transection	0	0	0	1	0	0	0	1
Serious	0	2	2	1	2	0	4	3
Totals:								
Transection	3	9	12	5	4	5	18	14
Serious	0	5	9	3	6	3	8	11

bronchitis and danger of drowning in his own respiratory-tract secretions that followed an upper-respiratory-tract infection in a patient with a low transection of the cervical cord. This necessitated evacuation of the bronchi by bronchoscopy daily for two weeks. Osteoporosis, contractures and deformity of the spinal column because of paraspinal muscular paralysis were among the multiplicity of complications of the thoracolumbar cases, and a self-inflicted urethral stricture and an atonic urethral sphincter were among those of the other two categories.

The Psychologic Problem

The theory that these patients, because of their catastrophic and disabling illness, present serious and overt psychologic difficulties is an attractive one but in my experience has been overemphasized. Psychologic personal, family and community maladjustments undoubtedly occur, and a psychotic maladjustment can be produced, no doubt, in these as in other persons by suggestion, tampering with the truth and jumping to unjustified and unsupported conclusions. In this series the unwillingness to work, the avoidance of social contacts and the loss of previously acquired ambulation skills doubtless have at least some connection with such maladjustments. There are also cases in this group of neglect or desertion on the part of a wife after the invalidism of her husband or her discovery of his sexual incapacity; these are noticeable for their infrequency, however. In contrast are the many cases in which a family life has been more closely integrated with an increased understanding of the needs and limitation of the paralyzed member by his or her spouse and a highly satisfactory adjustment to the family's social and community responsibilities.

The large majority of the patients in this survey fall within the limits of what is commonly recognized as the "working middle class." The minority includes families that are financially independent. The former cannot afford and for the most part could not understand the ministrations of a psychiatrist as a means of adjusting their differences. The latter have sufficient insight to make their adjustments without the psychiatrist's help. None had had the benefit of the public interest that goes with a favorable or interested press. It was therefore neither practical nor useful to call in psychiatric consultants in any case. Instead, an explanation of the responsibilities of the individual and the family together with a factual description of the possibilities and limitation of rehabilitation did away with any misunderstandings and maladjustments in practically all cases. In line with this, it has been my experience that aside from the basic personality deficiencies that were already present at the time of the injury later maladjustments after injury have practically always arisen from 5 causes. These were as follows: inaccurate or nonfactual descriptions of the injury; the making of promises that were not justified by demonstrable facts; the holding out of false hopes; the failure of the doctor to keep the patient and his family informed of the diagnosis and methods of therapy and what can be expected of either, as completely and as promptly as he knows it himself; and finally the misdirected but kindly meant efforts to "spare" the patient or his family "the pain" of knowing the truth. It has been my custom to present the facts as they exist and the prognosis as experience and the development of the case justifies and, with this background, to set up the process of rehabilitation as a challenge designed to try the determination, courage and initiative of both the patient and family.

Except for the necessary treatment of a psychosis existing before injury that was not altered by the injury, I have never had the occasion or felt the need of calling a psychiatric consultant to see any of the 292 patients (or their families) who survived long enough to permit the possible need to arise.

Eight patients had a pre-existing psychosis that the injury did not alter. Two are schizophrenic; 1 is paranoid; 1 is a manic depressive; 1 was a drug addict; 1 has an involutional psychosis; and 1 has a psychosis of unclassifiable type.

Twenty-one patients have given evidence of being upset about their treatment. One patient — the only one that might justify classification as a serious psychologic problem — committed suicide without any previous evidence of mental or emotional instability. Four others left the hospital against advice at their own request. Two have been heard from in this survey and are now well adjusted through their own efforts.

Sixteen have demonstrated by letter or otherwise that they are bitter, feel they have not had enough consideration, believe their treatment has done less for them than they were led to expect from it and are, in general, unco-operative and a family problem in that their adjustment in the family and community is bad. They resent advice, especially from the medical profession, and are practically all being helped financially by the federal or local government, through workmen's compensation payments or from charitable sources. At the most liberal interpretation, my experience indicates that less than 7 per cent of patients with injuries of the spinal cord or cauda equina can be expected to present any psychologic problem of any note whatsoever.

The Bone Injury

Except so far as it creates the problem of compression of the cord or cauda equina, the treatment of the bone injury has played virtually no part in the rehabilitation of these patients.

Three patients — 2 with a fracture dislocation of the cervical and 1 with a fracture dislocation of

the mid-thoracic spine — have redislocated after reduction. The 2 cervical cases were re-reduced and remained fixed after more traction and proper support. The third case remained dislocated. This was of no practical significance, however, since his cord was already transected, his spine has become stabilized, and he is fully rehabilitated. A manual closed reduction of one broken neck was carried out with anatomic reposition of the bones, simultaneous anatomic transection of the cord and immediate death of the patient. A few partial or complete open reductions — especially of the cervical injuries and only as an incidental part of an otherwise necessary laminectomy — were performed. No patients had the dislocated vertebras wired or otherwise tied together by use of the spinous processes, laminas or pedicles in any combination; indeed, in 2 cases wires put on the cervical spine elsewhere had to be removed as part of the necessary therapy. Other than the dislocations mentioned above, only 1 complication can possibly be traced to the spinal-column injury. This was a patient with a cervical-cord injury who developed a reversal of the normal cervical lordosis with drooping of his head forward. Associated with this was weakness and atrophy of the great posterior muscles of the neck. Intermittent in place of constant head support by a Thomas-type collar and self-administered resistive exercises for all his neck muscles have already provided relief from his symptoms.

Plaster of Paris

Body casts alone or so put on as to include the cervical spine in addition to the thoracic and lumbar regions have never been used or needed. They were tried as temporary therapy in 3 or 4 of the earlier cases. Even then the casts were used only as half-casts and shortly proved to be much less practical than other methods of handling these patients. In addition, by their impairment of respiration because of their weight and because of their compression of the abdomen, they increase the risk of death; and by their immovable position in relation to bony weight-bearing points on the surface of the body and consequent production of pressure and bedsores, they prolong the invalidism of and necessitate otherwise unnecessary major surgery on these paralytic patients. As far as my experience goes, the use of plaster of Paris in the treatment of injuries of the spinal cord, the cauda equina or the associated spinal injury is dangerous, unnecessary and contraindicated.

Fusion

With the exception of 1 cervical and 1 thoracic case in neither of which it did any good, and 3 caudal cases in which the bone, implanted while the patient was under treatment elsewhere, had to be removed on account of the compression of the cauda its presence produced, operative fusion has neither been needed nor performed in this series. The maintenance of bed rest with hyperextension or traction as indicated, until x-ray films show solid bony fusion by normal repair processes or demonstrate that abnormal motion in the injured region is no longer possible, has proved adequate in all cases. To be sure, many patients have worn supporting back or neck braces for additional periods as insurance, support and maintenance of posture mechanisms, but these have been removed as soon as it was safe. Training by corrective therapy[2] in balance and in the maximum use of the muscles that remain as functioning units is used to take the place of the splints and further to obviate the need for operative fusion.

The Cost of Rehabilitation

Rehabilitation of patients with paralysis following an injury to the spinal cord or cauda equina is at best extremely expensive. This aspect of the problem has a variety of sides to it. Of course, there is the actual money that has to be spent by family, relatives, friends or charitable organizations, or in the form of taxes and to maintain tax-supported hospitals and institutions for the care of chronic diseases, but there are other less apparent but just as important nonmonetary expenses. A hospital bed, for example, costs the hospital money, good will and patients if it cannot remain fluid, which it cannot if it is to be occupied for a year or more by one paraplegic patient unless the savings arising out of such occupancy are greater in the communities' eyes than the expenses are in the eyes of the superintendent of the hospital and his surgical staff. If one such bed in all the local community hospitals is thus tied up and duplicate therapy is demanded of each hospital unit, the inefficiency and waste of medical manpower is instantly apparent. If, however, all such patients are put in the county hospital the problem presented by them is put out of sight of everybody but the families involved. They shortly learn that no or, at best, extremely inadequate and disinterested therapy is provided under such conditions and only then by the kind of medical staff that will consent to work at a county hospital. Obviously, some different solution is called for.

In an effort to develop such a solution and because of the humanitarian as well as the financial angle, the Liberty Mutual Insurance Company of Boston, in the person of its vice-president in charge of claims, Mr. Stanwood Hanson, after four years of preliminary investigation and experiment, arranged about six years ago to concentrate such of these cases as they were responsible for on the Neurosurgical Service of the Boston City Hospital. At the same time, active consultative co-operation by the genitourinary service at the same institution was arranged for. In addition, through their nurse-

councilors and their other widespread facilities and with the active assistance of the corrective therapy staff of the Medford Ambulation Centre and their own Rehabilitation Centre, the families were kept indoctrinated, the patients encouraged and opportunities for job training provided. Later, when the patient was ready for it, employment was arranged for. In addition, constant accurate financial and other necessary records were kept and analyzed. In this way, it has been possible to compare their experiences with and predictions about such of these patients as have come under their control before and after this program was undertaken.

These data are complete on 26 such paraplegics and quadriplegics. Under the workmen's compensation laws of this and other states these patients are all classed as being permanently and totally disabled. The insurance carrier is therefore obligated to pay the claimant compensation for the rest of his life whether or not he does gainful labor. They are also financially responsible for all medical, medicinal, hospital, institutional, nursing and attendant care that the doctor, the patient, his employer, family and friends think that he must have. With the increase in life expectancy that has developed for these patients in the past ten years all such expenses have increased and are continuing to rise. No savings for the insurance company other than to the community and in the form of good will can be expected in the amount of money expended for the purely compensation payments. What savings there may be must come to them from a reduction in the amount of medical, hospital, institutional, medicinal, nursing and attendant care. There are also, of course, the intangible benefits that accrue with the resumption of gainful labor by the patient.

It is already apparent that rehabilitation with all its associated skills, its continued good health for the patient and the permanent redevelopment of the self-respect and initiative that come with self-care and an active social and work life has accomplished these ends and at the same time led to material financial savings. Thus, from 1943 through June, 1952, 26 paraplegics were rehabilitated by the Liberty Mutual Insurance Company as described above at a cost to the Company of $223,089. This is well summarized in the following quotation taken from the *Wall Street Journal* of June 26, 1953, where Mr. Hanson says: "We estimate our savings in payments for medical care and disability benefits that will not have to be paid at $1,446,000. Deducting the cost of rehabilitation, that's a net saving of $1,222,911 or a return of 600% on our investment." In addition, 17, or 65 per cent, of these 26 patients have been returned to remunerative employment.

The adaptation of such a program to a community or group of communities presents no overwhelming problem. The humanitarian aspects of such adaptation are indisputable. The financial savings are such as to make it virtually mandatory.

Life Expectancy

Is the rehabilitation of this group of patients such as will promise a reasonable life expectancy to the person involved? A categorical answer cannot be given this early to this question. However, excluding all but the 240 patients who have been followed more than eighteen months, it can be stated that to date only 7 patients (3 per cent) of this group have died as the direct result of their injury. It seems reasonable to conclude, therefore, that, with proper care *and* rehabilitation a patient's life expectancy is not materially altered as the result of any injury of the spinal cord or cauda equina provided he has survived for at least eighteen months.

Summary

Certain data pertaining to 445 patients who were for the most part civilians injured in civilian accidents and cared for in a civilian hospital are presented. Included in this group are 207 injuries of the cervical cord, 114 of the thoracolumbar cord, 51 of the lumbosacral cord and 75 of the cauda equina. These are further subdivided into 144 transections, 274 severe neural injuries and 27 minor neural injuries. The follow-up period has varied from a few hours to twenty-five years. Two hundred and forty have been followed for one and a half to twenty-five years, with an average of eight years, a low of one and a half, and a high of twenty-five years.

The corrected over-all mortality was 28 per cent. There was a decrease in mortality from 47 per cent during the ten years from 1930 to 1940 to 20 per cent in the last three and a half years.

One hundred and seventy-one, or 81 per cent, of 210 patients have 100 per cent self-care ability.

Eighty-five per cent (181) of 212 patients lead a fully (61 per cent) or partially (24 per cent) active social life.

One hundred and thirty-five (46 per cent) of 291 patients were fully or partially self-supporting and either owned their business or worked on a salary. Twenty-seven per cent will never be employable on account of their physical deficiencies. Eighteen per cent are employable but do not work.

One hundred and fifty-six of 199 patients (78 per cent) have satisfactory bladder control. They do not leak urine. Sixteen per cent have physical deficiencies that make urinary control impossible, and 6 per cent are unco-operative and will not bother to practice the control they have been taught.

One hundred and thirty-eight of 205 patients (67 per cent) have complete bowel control. Nineteen per cent have physical deficiencies that make such control impossible, and 14 per cent could have control but will not.

One hundred and forty-seven of 316 patients (46 per cent) walked normally or had no paralysis; 84 (27 per cent) walked only about their home or place

of business, and 85 (27 per cent) did not ambulate at all. Thirty-eight were bed ridden, and 56 made a wheel chair their sole means of locomotion. Thus, 30 per cent of the 316 patients were not ambulatory. Sixty-four, or 21 per cent, are physically incapable of walking, and 31, or 9 per cent, can but will not walk.

Of 135 patients who replied to this section of the questionnaire, 69 (51 per cent) had normal, 22 (16 per cent) had impaired, and 44 (32 per cent) had no sexual activity. Fifteen families, one spouse of which had been injured, had more than 23 children subsequent to the injury.

The greatest sources of late complications in patients that had been followed for eighteen months or more were: first, bedsores; secondly, attacks of bladder infection; and thirdly, genitourinary-tract calculi associated with infection in the tract.

Overt psychologic maladjustment was virtually nonexistent in this group of cases.

The bone injury and any associated dislocation, its therapy and its location, except so far as it caused compression of the cord or cauda equina played no significant part in the rehabilitation of this group of patients. A fusion of the spine was neither indicated nor performed on any of these patients. Plaster of Paris casts were neither used nor needed.

The initial cost of rehabilitation is high, but any money properly spent initially is more than returned in later individual, community and governmental savings. For an expenditure of $223,089 on 26 spinal paralytics there was a net saving of $1,222,911, or 600 per cent, on the investment.

If a patient who has had an injury to his spinal cord or cauda equina survives the injury for eighteen months or more his life expectancy appears to be little if at all altered from what it was before his injury.

Conclusions

Rehabilitation of all patients paralyzed as the result of an injury to the spinal cord or cauda equina is possible, is not too difficult and is of inestimable benefit to the patient, his family and his community. It is expensive but is infinitely less expensive than no rehabilitation. Medical and surgical skills capable of its accomplishment are available to all who may be interested in and able to use them.

References

1. Munro, D. *Treatment of Injuries to the Nervous System.* 284 pp. Philadelphia: Saunders, 1952.

2. Dening, K. A., Deyoe, F. S., and Ellison, A. B. *Ambulation: Physical rehabilitation for crutch walkers.* 188 pp. New York: Funk & Wagnalls, 1951.

CLINICAL FOLLOW-UP STUDY OF 398 PATIENTS SUSPECTED OF HAVING LUNG CANCER DISCOVERED IN THE BOSTON CHEST X-RAY SURVEY

James M. McNulty, M.D.

BOSTON

THIS paper presents the findings of a detailed follow-up study of the clinical records of 398 patients suspected of having lung tumor by a roentgenologic review board that interpreted the films of a total of 536,012 persons. It was prepared under the auspices of the medical subcommittee* on nontuberculous diseases of the Boston Chest Survey and conducted with funds provided by the Massachusetts Division of the American Cancer Society. The survey extended from September 15, 1949, to February 1, 1950.

An earlier publication† reviewed the organization of the survey and presented statistical information available at that time on the patients suspected of having cancer. The present paper is concerned with the analysis of the information obtained by the critical examination of the record in each case, supplemented by additional information obtained from hospitals and physicians. In certain cases information was obtained from the patient or the patient's family and, when such methods of follow-up study failed, from the death records in the communities in which the patients lived.

This analysis was undertaken with the advice of the subcommittee, which met on several occasions and suggested methods of procedure and the clinical evaluation of the cases. Careful scrutiny of each case record and the study of information obtained after the writing of the earlier paper has resulted naturally in changes in the final analysis. Certain patients with earlier diagnosis of cancer could not meet this critical appraisal, and the diagnoses were changed, the case being transferred to either a group with presumptive cancer or a miscellaneous group. Some of the cases of the presumptive group still alive after approximately three years were dropped from that group and transferred to the miscellaneous group.

Table 1 summarizes the results of the present follow-up study of all cases. It is noteworthy that there were 39 cases (9.8 per cent) of proved bronchogenic carcinomas among a total of 398 cases in which

*The subcommittee included Dr. Thomas J. Anglem, chairman, and Drs. Herbert W. Adams, Theodore L. Badger, Howard A. Frank, Joseph P. Lynch, Harlan F. Newton, Richard H. Overholt, John W. Strieder and Richard H. Sweet.

†Scamman, C. L. Follow-up study of lung-cancer suspects in mass chest x-ray survey. *New Eng. J. Med.* 244:541-544, 1951.

tumor was suspected (Table 2). Thirty-three of the 39 patients were men, and 6 were women. There was 1 case in the fourth decade, 6 in the fifth, 14 in the sixth, 13 in the seventh, 4 in the eighth and 1 in the ninth.

TABLE 1. *Follow-up Results in Cases Classified as Presumptive Tumor.*

RESULT OF STUDY	NO. OF CASES
Primary bronchogenic carcinoma — proved	39
Primary bronchogenic carcinoma — presumptive	13
Metastatic pulmonary tumors	19
Other types of cancer	1
Miscellaneous group	275
No follow-up report	51
Total	398

Recent studies of the 39 patients with primary carcinoma show that 22, or 55 per cent, were resected and that of these 5, or 13 per cent, were alive and apparently well three years after the date of the original survey film.

The roentgenologic review board tried to assess each case according to x-ray findings at the time of the initial reading of the survey film. Group 1 included cases in which the presence of cancer was considered very probable. Group 2 comprised cases in which the differential diagnosis between tuberculosis and cancer was less certain; metastatic tumors were also included in this group. Group 3 consisted of benign tumors (probable) — dermoid, substernal thyroid, neurofibroma and so forth.

Of the total number of proved cases 33 were classified as probable tumor, Grade 1, by the roentgenologic review board, 4 as Grade 2, and 2 as Grade 3. Thus, there was a high degree of correlation between this classification of the review board and the subsequent clinical findings, at least in these 39 cases of proved primary bronchogenic cancer. Of the proved cases of primary lung cancer the average interval between the original survey film and final diagnosis was fifty-six days.

There were 13 presumptive cases of primary lung cancer. This is an admittedly unsatisfactory classification since the evidence for the diagnosis of primary lung cancer in these cases is somewhat tenuous. These diagnoses were made on the basis of x-ray readings alone in 3 cases, and x-ray readings with a very suggestive clinical history in the others. Failure of further clinical investigation or surgical exploration in this group resulted largely from lack of co-operation on the part of the patient in most cases, advanced age in 2 cases, deaths early in the follow-up period in 2 cases, and bilateral involvement and inoperability in 1 case. At present 6 of these 13 patients are known to be dead. Nearly all these were signed out as cancer, but without autopsy; 1 is alive, and some increase in the size of the lesion has been demonstrated in subsequent x-ray films. No information is available on the remaining 6 patients except that their names do not appear on the death records for the years 1950–1951. These cases are considered to deserve a separate classification since the findings in each, although incomplete, are suggestive of primary lung carcinoma, and their inclusion in the miscellaneous group below would tend to alter their significance. It is further believed that a presumptive classification of cancer is unavoidable in a study such as this in which cases are drawn from all walks of life and in which levels of intelligence, language barriers and other obstacles prevent follow-up study to a final conclusion in all cases.

TABLE 2. *Follow-up Results in Proved Cases of Primary Cancer of the Lung.*

METHOD OF PROOF	PATIENTS ALIVE AND WELL	PATIENTS DEAD	PATIENTS IN POOR CONDITION	NO FOLLOW-UP REPORT	TOTALS
Resection*	5	11	2	4	22
Exploration		4		2	6
Papanicolaou test only†		4	1	2	7
Biopsy of lymph node		3	1		4
Totals	5	22	4	8	39

*Resection not carried out in 17 cases.
†Operation not performed in 2 cases because of advanced age and general debility, and in 5 others because of obvious extension.

One case of primary lymphosarcoma of the lung in a thirty-seven-year-old woman is not included in Table 2. It is noteworthy that in the miscellaneous group 5 bronchial adenomas were operated upon, 1 of which was reported as invasive. Whether this single case of invasive bronchial adenoma should be considered as a cancer is controversial.

TABLE 3. *Types of Metastatic Lung Tumors.*

TYPE OF TUMOR		NO. OF CASES
Metastatic carcinoma		15
Large bowel	8	
Breast	6	
Stomach	1	
Hypernephroma		2
Neurogenic sarcoma		1
Melanocarcinoma		1
Total		19

There were 19 metastatic tumors of the lung (Table 3). In several of these cases the lesion in

the lung was known by the attending physician before the report of the survey film.

There were 275 cases that were classified in the miscellaneous group. Space does not allow a complete listing of the diagnoses submitted, but Table 4

TABLE 4. *Final Diagnosis in Miscellaneous Cases.*

DIAGNOSIS	OPERATION NO. OF CASES	NO OPERATION NO. OF CASES
Tuberculosis	10	71
Other infection	6	36
Mediastinal lesion	20	31
Chest-wall lesion	3	11
Diaphragmatic lesion	4	9
Vascular lesion	1	9
Others	20	27
No disease	0	17
Totals	64	211

lists the cases in comprehensive groupings. It will be noted that 81 cases of this miscellaneous group were finally classified clinically as some form of tuberculous infection. This illustrates the difficulties encountered by the roentgenologic reviewer in an attempt to establish an absolute diagnosis on x-ray evidence alone. Nearly all these cases were classified by the x-ray review board in Group 2, as has been mentioned above.

Finally, there were 51 cases classified as failures because of inadequate, or complete lack of, follow-up data. These were the cases in which, despite attempted follow-up study through the patient, clinic, family or attending physician, no diagnostic information was obtained. These cases, like those classified as presumptive cancer, apparently were unsuccessful so far as follow-up data were concerned because of lack of co-operation on the part of the patient and the patient's family, advanced age or moving out of town or out of the state and, occasionally, through lack of co-operation on the part of the attending physician.

DISCUSSION

The general opinion that the silent lung cancer discovered by routine chest x-ray surveys will be more susceptible of cure than when the cancer has manifested itself clinically hardly seems to be open to question and the planned mass chest survey appears to be the technic by which such early cancers could be discovered in greater numbers. The two chief questions raised as a result of this analysis are whether the carcinomas discovered are more curable than those encountered in ordinary practice and whether they can be turned up in sufficiently large numbers to warrant consideration of the mass chest survey as a practicable means of control of pulmonary cancer.

In assessing the information gained from this study one must emphasize the fact that the chest survey was directed primarily against tuberculosis and the tremendous expense of conducting it must be charged off almost entirely against the control of that disease. However, if the technic of the mass chest survey is to be considered as a method of control of pulmonary cancer, this fact must be discounted. A single survey, although it may provide useful and interesting information, can have no significant effect on the control of lung cancer. To be effective and to detect new early lesions as they develop, it must be repeated indefinitely at intervals of not more than four or six months and must cover a substantial percentage of the population in the affected age groups. Unless it is reasonable to expect repeated surveys directed at tuberculosis at such intervals, the entire staggering cost of such a program will have to be charged against the effort at cancer control.

In the light of these considerations the result of this study can hardly be considered as anything but discouraging. The incidence of case finding — namely, 39 primary cases of lung cancer out of 536,000 persons surveyed, or a little less than 1:14,000 — is depressingly low. Of even greater significance is the fact that of 22 resected patients only 5 were alive and well at the end of this follow-up period.

Equally discouraging is the fact that almost half the patients found could not be resected so that the survey did not, in fact, as might have been hoped, uncover the disease in a significantly earlier phase than that seen in ordinary practice.

The incidence of cases classified as failures because of inadequate or complete lack of follow-up data was disappointingly high. However, it may be anticipated that the percentage in future surveys will diminish as the significance of the silent lung shadow becomes more widely appreciated by the family physician and the public.

The long delay, averaging fifty-six days, between the time of the initial survey film and the establishment of a final diagnosis is a disconcerting finding, undoubtedly nullifying to a considerable extent the advantage gained by earlier disclosure of the lesion. With further experience in the conduct of the follow-up procedure there is no reason to doubt that this period of delay can be sharply reduced.

In a consideration of methods by which the staggering cost of the mass chest survey for cancer may be reduced, limitation to the older age groups and possibly to the male sex suggests itself. In this study, of 39 patients with primary bronchogenic cancers detected in the original reading of the survey films, 32, or about 80 per cent, were fifty years of age or older, and of this group of 32, 28, or 90 per cent, were men.

Limitation of the survey to men over the age of fifty would undoubtedly increase the rate of case finding. However, such a limited survey could hardly be combined with one directed at tuberculosis.

The isolated or infrequently repeated mass survey, although it may not make any significant impression

on the control of lung cancer, provides information of great value and data meriting further study. It would be of great interest, for example, to undertake another follow-up study of all cases turned up in this survey after a period of five years has elapsed. This would provide a final and more absolute account of the value of such surveys in the detection of lung cancer.

In the large miscellaneous group (Table 4), which included a considerable number of patients with diagnoses of tuberculosis, tuberculoma, bronchiectasis and so forth, the diagnosis must be considered only tentative unless the patients have been explored surgically or are followed over a long period. It seems probable that some additional cases of cancer will be discovered among them. The true incidence of cancer of the lung among the surveyed population will not be known until such a follow-up study is made. The miscellaneous group is so large in proportion to the total suspect group and shows such a varied set of conditions that clinically and statistically it might well be studied at a later time.

Despite the economic obstacles to the use of frequently repeated, planned surveys, the screening principle has proved itself capable of turning up some cases of early cancer that might not otherwise have been detected. When such screening can be carried out as part of existing routines, as in hospital admissions, and examination of employees in business and industry, its use should be encouraged and expanded.

Moreover, in a survey directed at tuberculosis the additional costs of providing for the follow-up study of the relatively small group of tumor suspects is so small in relation to the whole cost that where such surveys are planned, advantage should be taken of these opportunities for the detection of lung cancer.

270 Commonwealth Avenue

MEDICAL PROGRESS

PLASTIC SURGERY: FACIAL INJURIES*

BRADFORD CANNON, M.D.,† AND JOSEPH E. MURRAY, M.D.‡

BOSTON

THE following quotation is taken from the outline of "Principles of Treatment of Severe Facial Injuries"[1] prepared for the American College of Surgeons:

> In few injuries is the final outcome so directly dependent on early proper care as in the treatment of a severe facial injury. The bony and cartilaginous framework of the face supports the soft tissues and teeth, and provides attachment to the muscles of expression and mastication. The character in the face, the emotional expression, and the function of chewing and eating depend upon a normal anatomical and functional relationship between these structures. Failure to restore the displaced bone to its normal position or failure to resolve the puzzle of a jagged laceration of the eyelid, nose or mouth may result in disfigurements which will permanently alter the appearance and function of the face. Only by early reduction of all fractures and adequate splinting of the fragments before fixation of the bones has occurred, can the normal contours of the face be restored; and only by accurate layer closure of the soft tissue will function be re-established and scarring minimized.

In putting these principles into practice, the surgeon will be awed by the maze of technics, appliances, prejudices and conflicting opinions that have found their way into the surgical literature in recent decades. The purpose of this paper is to point out the various problems, cite simple and effective methods of dealing with them and indicate the sources from which additional detailed information can be obtained.

EMERGENCY CARE AND TRANSPORTATION

The emergency care and transportation of patients with severe facial injuries was discussed briefly but completely by Ivy and Stout[2] just before World War II. Three problems of concern to the surgeon, any of which may be life saving, are emphasized: the arrest of hemorrhage, the establishment and maintenance of an adequate airway and the support and protection of the damaged tissues.

Local pressure or packing of the wound or wounds with sterile gauze is usually sufficient to control hemorrhage, but clamping of a lacerated large blood vessel is sometimes necessary. The clamp may be left in place or the bleeding vessel ligated if feasible. In all these manipulations, interference with respiration or the respiratory passages is to be avoided. Prompt blood replacement should be instituted in conjunction with the control of hemorrhage.

The normal airway may be obstructed either by backward displacement of the tongue and floor of the mouth or by hemorrhage. A collapse of the mandibular arch or a backward and downward displacement of the roof of the mouth will crowd the tongue against the pharynx. Traction on the tongue with a suture or even with a safety pin inserted through the tip, or traction on the displaced bone, should relieve the obstruction effectively. The insertion of an endopharyngeal tube or an endotracheal tube may be desirable. In the insertion of either, additional damage to the soft tissues must be avoided. Tracheotomy is seldom necessary and may add to the patient's difficulties.

Support and protection of the damaged tissues by application of a well padded bandage beneath the chin and around the head and face will reduce the possibility of further contamination, slow the development of local edema and reduce the patient's local discomfort. Under no circumstances should

*From the plastic clinics of the Massachusetts General Hospital, and the Peter Bent Brigham Hospital, Boston, and the Mount Auburn Hospital, Cambridge, Massachusetts.

†Clinical associate in surgery, Harvard Medical School; associate visiting surgeon, Massachusetts General Hospital.

‡Assistant in surgery, Harvard Medical School; junior associate in surgery, Peter Bent Brigham Hospital.

any but the most urgent manipulation be done until after a careful general evaluation of the patient can be made and he is in an operating room, prepared for definitive treatment.

For transporting the conscious patient the upright position has proved best. He is able to cough effectively and can rid the mouth of obstructing blood or secretion by leaning forward. The unconscious patient should be transported in a face-down position. The displaced tissue of the mouth will fall forward away from the pharynx, and the aspiration of blood will be reduced to a minimum.

Diagnosis

Critical injuries of the brain, chest and abdomen and major fractures must often take priority in treatment over facial injuries. Examination of the cervical spine should not be overlooked, since the force of the blow to the face may be transmitted to that area. The definitive care of the facial injury should be postponed until the patient has recovered consciousness or until other critical injuries have been attended to. Cerebrospinal-fluid leakage from the nose has been considered a contraindication for manipulation of fracture of the nose or facial bones. However, the effectiveness of the antibiotics and the benefit that comes from early reduction of these fractures have turned present-day opinion toward earlier reduction of fractures and suture of lacerations despite cerebrospinal-fluid drainage. Minimal manipulation is permissible in the presence of other injuries to lessen the patient's discomfort and to simplify later repair.

The local injury to the face varies widely in severity. There may be abrasions, superficial cuts or deep bruises that, although not serious, may produce disfiguring scars if improperly treated. More serious injuries result from deep lacerations, especially in kinetic areas, from penetrating wounds, from losses of soft tissue or bone and from displacements of the bony or cartilaginous supporting structures of the face.

Straith,[3] studying a series of facial injuries in automobile accidents, indicates a characteristic pattern of the injury to the passenger in the front seat that he calls "guest passenger injuries." He describes three types: the head is thrown forward against the windshield, causing cuts of the head and neck when the glass breaks; a combination of cuts from the windshield and crushing injuries to the upper face results when the face strikes against both the top of the dashboard and the windshield; and a crushing and bursting injury of the face results from striking against the irregular front surface of the dashboard. As a result of these observations and Straith's recommendations, one automobile manufacturer has incorporated a crash pad on the dashboard, and others have constructed a windshield that is pushed out on forceful impact.

Superficial lacerations will be apparent on inspection, but the detailed pattern may be obscured by dried blood or a dressing. Malocclusion of the teeth is the most obvious evidence of fracture of either the mandible or the upper jaw. In fractures involving the bones of the middle third of the face there may be a palpable deformity of the nose, the orbital rim or other bony prominence, without loss of normal occlusion.

A determination of the nature of the trauma producing the injury is important since it will influence treatment. If the details are known, foreign bodies, glass, dirt or bits of clothing will be sought in the depths of the wound, or powder, tar or oil imbedded in the tissues may be suspected. Missing teeth or detached fragments of bone should not be overlooked. They may be imbedded in the lacerated soft tissues and should be removed.

Before any treatment is contemplated, a careful neurologic examination of the face is essential. Vision and motion of the eyes should be determined. Partial or complete loss of function of the seventh nerve and any sensory disturbances should be noted. Losses of mobility or sensation of the tongue are also important and may indicate severe and extensive damage.

X-ray studies of the facial and jaw bones are important for confirmation of the clinical findings and as part of the patient's record. Proper posing of the head is essential for informative films. By posing in both the vertical-sub-mental and Waters positions, fracture and displacement of the rims of the orbits, the zygomatic arches, the lateral and medial walls of the antrums, the bony structure of the nose, the alveolar arches and the palate will be visualized. Detailed visualization of the nose requires a soft lateral view and an anteroposterior downward view with a small film held against the roof of the mouth. Mandibular x-ray studies should include views of each side of the jaw, the symphysis and both condyles. The direction of the mandibular fracture lines, the amount of displacement, the degree of over-riding of the posterior fragment and the condition of the teeth adjacent to the fracture line may all influence the method of treatment chosen.

General Considerations in Local Repair

Lacerations of the face and fractures of the jaws should receive definitive treatment in the first twelve to twenty-four hours after injury, before swelling has become prominent and before organization of blood clots or infection develops. If circumstances make delay imperative, the lacerated edges of skin can be drawn together with adhesive strips or loose suturing, and the displaced bony structures of the face or jaw supported by a bandage. Delays in the replacement of bone fragments of over seven to ten days may make realignment impossible because of the rapid fusion and fixation of the numer-

ous comminuted fragments. Lacerations in a child are often best treated by adhesive strips alone. A dread of hospitals, anesthesia, sutures and so forth need never be kindled in the child's mind.

Local anesthesia is preferable in the definitive repair of most facial injuries. The topical application of cocaine or its equivalent usually suffices for uncomplicated nasal fractures. Local infiltration with novocain is useful for most skin lacerations but nerve block (infraorbital, mental or others) may be preferable to avoid distortion of the soft tissues. Nerve block may also be desirable if maintenance of an adequate airway is difficult and if at the same time complete anesthesia of the face is needed.

This is accomplished by block of the second and third divisions of the fifth cranial nerve and infiltration of the cervical nerves that extend upward across the body of the mandible.[4] In children general anesthesia may be essential. In complex injuries of the face and jaws, endotracheal anesthesia is preferable because of the length of the procedure and the desirability of a tube in the trachea during and after the operation. However, the postoperative dangers of aspiration of secretions and the hazards of immediate fixation of the teeth in occlusion must be kept in mind when general anesthesia is used. Postoperatively, the endotracheal tube may be kept in place until the patient is virtually fully conscious.

Preparation of the Wound

Thorough cleansing of all facial wounds is an essential preliminary to definitive treatment. A local anesthetic may be injected before the wound preparation or, better, after the preliminary washing. Final preparation should include irrigation and gentle scrubbing, mild detergent soap being used. If dirt or oil has been ground into the skin, vigorous scrubbing with a brush is necessary. Despite the trauma of such a procedure, it is time well spent and may eliminate the need for a later operation. Loose dirt, hair, glass and other foreign bodies, and detached chips of bone should be sought for and removed.

Débridement of the tissues of the face should be minimal, in contrast to the complete wound excision recommended elsewhere in the body. An ill advised débridement of skin about the eyelids or mouth or the failure to replace skin lost from them may result in a significant deformity. "It is better to save tissue which may die than to sacrifice any which may survive."[5] A piece of skin partially or even completely detached often survives as a free transplant if replaced in its normal position, sutured loosely with minimal tension and protected by a firm dressing.

Management of Fractures

Fractures of the facial bones differ from most fractures because the displacement is produced by the trauma itself and not by the pull of attached muscles. Consequently, in the reduction of fractures of the face, the displaced bones must be replaced in their original position and held in place against the minimal elasticity of the soft tissues and the force of gravity.

The fragments in mandibular fractures, on the other hand, are displaced by the action of the very powerful muscles of mastication. In the reduction and fixation of these fractures, appropriate splinting must be employed to control the pull of the muscles (Fig. 1).

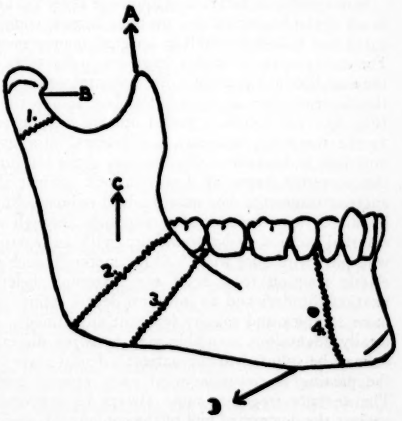

Figure 1. *The Mandible.*

Arrows indicate the pull of various groups of muscles: the temporal (A), *external pterygoid* (B), *masseter* (C) *and muscles attached to the hyoid bone* (D). *Numbers indicate some common fractures: neck of the condyle* (1), *angle of the jaw behind the last molar tooth* (2), — *over-riding is common in this fracture and may require operative reduction,* — *angle of the jaw between molar teeth* (3) — *the third molar tooth prevents over-riding of the fragment if there are upper teeth in contact with it* — *and a common fracture in the region of the mental foramen* (4).

Two useful aids in the diagnosis of fracture, malocclusion of the teeth and palpable deformity of the bony prominences of the face, are equally valuable in determining the accuracy of the reduction of fractures of the jaw or face. Such simple indicators should be an inducement to utilize direct surgical methods in the treatment of these fractures. The final reduction can thus be achieved promptly, the patient will be relieved of the discomfort of unstable fragments, and the constant adjustment of complicated appliances will be unnecessary. These principles are in keeping with the current trend toward prompt reduction and positive fixation of fractures elsewhere in the body. The morbidity and duration of hospitalization will be reduced by employing direct and accurate technics.

Most mandibular fractures can be reduced and fixed in position by wiring of the upper and lower

teeth in occlusion. Wires around two pairs of opposing molar teeth on each side of the upper and lower jaws are twisted together to form four buttons to which elastic bands can be attached, or the wires on the opposing teeth are attached to each other to furnish more absolute fixation. The latter is undesirable if a general anesthetic has been used because the mouth cannot be easily emptied of vomitus, thus increasing the chance of aspiration. Final wiring of the teeth may have to be delayed until the patient is fully conscious.

When teeth are either inadequate or absent in any or all of the fragments, the problem is more complicated but still lends itself to surgical management. For example, the posterior fragment in fractures of the mandible at the angle is often edentulous because the fracture line is behind the last molar tooth (Fig. 1). The ramus is pulled upward and inward at the temporal, masseter and internal pterygoid muscles. If, because of the direction of the fracture, the posterior fragment does not lock against the anterior fragment, they must be held reduced either by direct wire fixation after exposure through an external incision or by transfixion with an internal wire-pin (Kirschner wire).[6] Other methods, such as elastic traction to a head cap, external skeletal fixation (Stader) and an intraoral dental splint, are more complex and require frequent adjustment. A totally edentulous mandible may be wired directly or may be splinted to the patient's dental plate by the passing of circumferential wires around each. The anterior fragment must always be supported against the downward pull of the geniohyoid, genioglossi, digastric and mylohyoid muscles. Occlusion will be restored if the lower plate is attached to the upper teeth or to the upper dental plate, which must be supported against the roof of the mouth by wire fixation. Fractures of the symphysis may be unstable laterally and require direct wiring of the lower border or transfixing with an internal wire-pin (Fig. 2). The management of a fracture of one or both condyles is still a controversial matter. Some authors advocate open reduction of most of these fractures. Others consider this meddlesome surgery because exposure and fixation of the tiny condylar fragment is quite difficult.[7] With rare exceptions an excellent functional result can be expected if the mandible is splinted in normal occlusion until the condyle has united.

Fractures of the mandible with loss of bony substance require the accurate maintenance of dental occlusion. Early restoration of continuity of the bone must be planned as soon as soft-tissue healing permits.[8] Rib or iliac bone grafts may be used and will act as an effective splint for any nonimmobilized or edentulous fragments.

Since practically all mandibular fractures are compounded into the mouth, the risk of infection is always present. For this reason nonvital loose teeth in the fracture line should be removed unless they are useful temporarily as a splint. External drainage of the fracture line may be desirable until the mucosa is healed.

In the evaluation of the healing of mandibular fractures the x-ray film may fail to reveal any

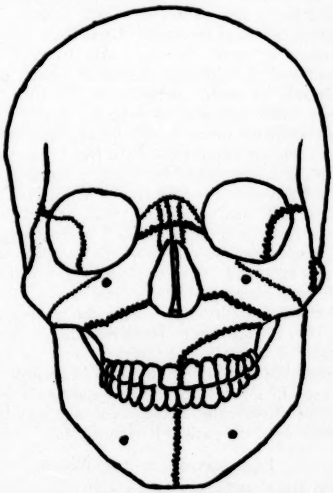

FIGURE 2. *Common Fracture Lines in the Face.*
The upper transverse fracture, at the level of the orbit, may involve important suture lines and membranous bones that form the orbital walls, the temporal fossa and the nose. The lower transverse fracture, at the level of the floor of the antrum, may involve the maxilla, nose and nasal fossae, as well as the palate. The alveolar fracture involves the alveolar process and possibly the floor of the antrum. Malar fractures usually traverse the zygomaticomaxillary fissure, the frontozygomatic suture line and the sphenozygomatic suture line, and are associated with a comminuted fracture of the anterior antral wall and the floor of the orbit. The zygomatic arch is usually fractured at the zygomaticotemporal suture line, but may break at any point. Fractures of the mandibular symphysis are unstable because of the rocking motion produced by the action of the masseter and internal pterygoid muscles.

callus. A more reliable test is clinical examination of the bony union. Fixation of six to eight weeks is usual in uncomplicated mandibular fractures.

The upper jaw and face are formed by many bones, any of which may be involved in a fracture. The weakest parts of this complex are at the several suture lines of the major bones and in the thin membranous bones that form the walls of the facial cavities. As a consequence well defined patterns are usually observed in these fractures (Fig. 2).

The most common is a fracture of the nose. Any injury to the nose associated with bleeding must be considered a fracture until proved otherwise. Many fractures may not be obvious even after carefully performed x-ray studies, either because of difficulty in positioning or because cartilaginous structures

only are involved. A well defined laceration of the lining membrane of the nose is usually caused by a sharp edge of thin bone and is indicative of fracture. The absence of external visible deformity of the nose should not mislead the surgeon. Irregularities of the bony structure are usually palpable but a buckling of pliable bone or cartilage, particularly in children, may be overlooked. The stresses created by minimal displacements, if untreated, may lead to progressive changes in the shape of the nose or to distortion and deviation of the septum.

Most fractures of the nose or nasal septum can be reduced by prompt elevation and replacement of the fragments, a blunt instrument being used within the nose to press outward on the dorsal structures. The reduction can be controlled by external digital pressure, and the accuracy checked by palpation. Only if there is such severe comminution that the framework is unsupported will a splint be necessary. Through-and-through wires passed between the comminuted fragments and fastened to pieces of soft metal molded to the side of the nose provide a simple and effective splint until healing is complete.[6]

The malar bone is subject to direct trauma because of its prominence. The bone is massive and consequently is seldom fractured except by a penetrating object such as a missile. Displacement of the malar bone is the usual result, with separation at the suture lines between it and the adjacent bones, and a shattering of the thin walls of the antrum into small fragments. Examination reveals a flattening of the cheek that may be masked by the rapid development of edema in the overlying soft tissues. Irregularities in the rim of the orbit at the suture lines will be palpable, and there may be anesthesia of the upper lip. If there is posterior displacement of the malar bone or if the zygomatic arch is displaced inward by a direct blow on the side of the head, there may be interference with the forward movement of the coronoid process and thus a reduction in normal mandibular excursion.

The displaced malar and related bones are most readily repositioned from within the antrum. The antrum is entered through an incision in the upper buccal fornix. A blunt instrument passed between fracture lines in the anterior antral wall is used to engage and elevate the bones, which are usually displaced downward and backward. If most of the displacement is backward and inward, with the zygomatico-maxillary suture line acting as a fulcrum, or if the zygomatic arch is displaced inward, a temporal fossa approach is preferable. This may be either through the buccal fornix posteriorly or through an incision in the temple within the hairline. In either case the fragments are pried outward by a blunt instrument inserted behind the bone in the temporal fossa. Usually, the reduced fragments lock themselves in place, but if there is much comminution, splinting may be necessary. A pack in the antrum provides good support for the loose bones but may be uncomfortable for the patient. Skeletal fixation is seldom necessary. There is usually solid bony union in two or three weeks. The membranous bones of the antral wall, floor of the orbit and side of the nasal passages will fall into place if the major bones are replaced. It is futile to attempt exact replacement of these "Humpty Dumpty" fragments.

If these fractures are untreated, serious functional as well as cosmetic disabilities may result. The most serious is diplopia from failure to raise the orbital floor and restore the normal support of the eyeball. To correct this disability later requires the transplant of bone or cartilage to the orbital floor. Motions of the mandible may be permanently limited by encroachment on the coronoid process, which may have to be excised to permit normal motion. The symmetry of the face will be permanently distorted unless the normal bony contours are restored.

Fracture of the alveolar process may involve any segment of the alveolar arch. Fixation either by wiring to the adjacent undisplaced teeth or interdental fixation may be employed. Rarely is the displacement so severe that the blood supply to the bones and retained teeth is destroyed.

Transverse fractures of the upper jaw are the most serious and usually the most difficult to treat. Two general types are encountered. In one the fracture traverses the facial bones at the level of the floor of the antrum, separating the alveolar process from its normal attachments to the upper jaw. In the other the fracture lines cross at the level of the orbits, usually involving the nasal, malar, lachrymal, ethmoid, and other facial bones. The most significant deformity in each of these transverse fractures is elongation of the face caused by the separation of the fractured bones from the skull. There is malocclusion of the teeth associated with the downward and often backward displacement of the face. The displaced bones must be mobilized and supported to lessen the elongation of the face and to facilitate restoration of normal occlusion. The recent demonstration by Adams[9] of internal wire fixation of the displaced fragments to the stable orbital rims or to the zygomatic arches is a valuable contribution to the subject of facial fractures:

> After using numerous types of extraoral appliances, including those attached to plaster headcaps, for immobilizing fractures of the maxilla and other facial bones, the author has found these appliances are complicated, their preparation and application are time consuming, they are cumbersome and uncomfortable for the patient, and they require close watching and repeated adjustments on the part of the surgeon. The fact that practically everyone treating these fractures has a different type of external appliance suggests that this method is not entirely satisfactory . . . .
>
> This method [open reduction and fixation by wiring] not only meets the requirements of facility of operation, complete immobilization, and sound surgical principles, but is applicable to practically every type of fracture of the facial bones. The procedure may be carried out with only a pair of pliers, a small drill and dissecting set, and a spool of fine stainless steel wire. Since complete immobilization is obtained, repeated readjustments are unnecessary and the patient is spared much discomfort and inconvenience.

When this method is used immediate and accurate reduction and fixation are possible, occlusion can be re-established promptly, and the cumbersome external appliances that require such constant adjustment can be discarded. Support for the upper jaw and splinting of the teeth in occlusion must be continued for six to eight weeks. The wires passing through the cheek may be removed at that time or left in place indefinitely.

Management of the Soft Parts

All fresh lacerations of the face should be repaired promptly. Only by early accurate closure of skin and mucous membrane can scarring and deformity be reduced. The healing power of the face is excellent and the resistance to infection high. Success depends on the observation of certain precautions, the most important of which is to do no additional damage. These include avoidance of unnecessary débridement, wide sutures, which will leave stitch marks, and excessive tension, especially on flaps of skin with precarious blood supply. All wounds must be thoroughly cleansed, foreign material removed, and hematomas evacuated. Layer closure of the subcutaneous tissues as well as the skin must be done with very fine suture material. All skin sutures should be removed within forty-eight to seventy-two hours.

Great care and patience are necessary in identifying and replacing the jagged edges of torn and avulsed skin of the eyelids, nose and mouth, especially if the laceration extends through both surfaces of the part with a full-thickness separation of the edges. The fitting together of obscurely misplaced flaps may require several attempts before the correct position is obtained. Obvious points of approximation such as the vermilion border, the eyelid margin or the alar margin are useful as starting points for suturing.

Sutures on the inner surface of the mouth, nose or eyelid should be only enough to obtain accurate apposition of the mucosa. Puncture wounds, especially of the lips, are best left unsutured. Free drainage is thus maintained, and the likelihood of infection lessened. Small lacerations on the face can sometimes be approximated by adhesive support alone. The method is often preferable in children because anesthesia, sutures and so forth are then unnecessary.

Skin losses can be replaced by a skin graft if the deep tissues are not severely damaged. In extensive full-thickness losses of the cheek, nose and, rarely, the eyelid, mucosa and skin may be approximated to close the raw surface in anticipation of later repair.

Suture of branches of the seventh nerve in the face is impractical because the fibers are tiny and identification may be impossible. If the larger trunks near the angle of the jaw can be identified, suture is indicated. Primary repair of a lacerated Stenson duct should be considered in injuries of the cheek. A tiny probe or piece of suture material may be used as an internal splint. The tissues of the cheek are often so badly injured that repair may have to be postponed.

Among the most troublesome of all the lacerations of the face are the so-called "trap-door flaps" caused by U-shaped lacerations in the face. In these U-shaped lacerations and in curved lacerations crossing the cheek, the body of the mandible or elsewhere on the nose or face, the normal contraction of the healing scar tissue produces a fullness of the skin on the concave side of the scar or thickening of the scar where it crosses normal folds. In anticipation of these deformities some surgeons recommend primary small "zigzag" flaps to avoid straight-line suturing of these lacerations.[10]

That secondary revision of the soft tissues may be necessary in many severe facial injuries must be anticipated in the management of the primary wound. Nothing should be done to make the later procedures more difficult.

Dressings

A firm, resilient pressure dressing is essential after the definitive primary reduction of facial fractures and after suture of facial wounds. It is also useful before treatment if there are to be unavoidable delays. Oozing of blood from the damaged tissues and the further development of edema are best controlled by such a dressing. Edema, which develops rapidly after injury and manipulation of the tissues, may persist for many weeks or months unless it is reduced to a minimum by the prompt application of a firm dressing.

Postoperative Care

Chemotherapy, antibiotics and other agents are indicated in all severe facial injuries. The choice will depend on the condition of the mouth and tissues, the character of the injury and the surgeon's preference. Tetanus prophylaxis must not be overlooked. Gas gangrene in the face is almost unheard of, however. The usual supportive measures should be continued, including fluid by vein and transfusions, until the patient is able to take sufficient fluid and food by mouth. A high-calorie, high-vitamin liquid diet must be available for all patients with interdental wiring.

In all patients with fractures compounded into the mouth or nose, *cleanliness* is essential. Irrigations, mechanical removal of débris and mouth washes are useful. Patients with interdental wiring may have real difficulty in keeping the mouth clean unless frequent irrigations are given. Mechanical cleansing of the teeth with a short-bristle toothbrush is desirable.

Dressings should be replaced after the skin sutures are removed on the second or third day. The tissues in severe injuries need the support of a dressing

for about a week. The dressing serves also as a splint for bony fragments that do not solidify before the seventh to the tenth day.

Fractures of the mandible and those requiring interdental fixation must be splinted for six to eight weeks until the bone fragments are firmly healed. Other fractures (nose, malar bone and zygomatic arch) are usually firmly enough healed in two or three weeks for all splints to be removed.

Summary and Conclusions

Facial injuries may result in permanent disfigurements unless well established principles of treatment are followed. Some of the concepts of treatment differ from those recommended in other parts of the body, and some of the methods appear confusing unless carefully studied. It is hoped that this paper will prove helpful to surgeons dealing with these injuries and will stimulate interest in the use of simpler and more direct methods.

References

1. Cannon, B. Unpublished data.
2. Ivy, R. H., and Stout, R. A. Emergency treatment of war injuries of face and jaws. *Ann. Surg.* **113**:1001-1009, 1941.
3. Straith, C. L. Guest passenger injuries. *J. A. M. A.* **137**:348-351, 1948.
4. Brown, J. B. Deep block anaesthesia of second and third divisions of fifth nerve. *Surg., Gynec. & Obst.* **53**:832-835, 1931. Blair, V. P., Ivy, R. H., and Brown, J. B. *Essentials of Oral Surgery.* 606 pp. St. Louis: Mosby, 1936.
5. Ivy, R. H., et al. Symposium on plastic and reconstructive surgery. *Clinics* **2**:1165-1193, 1944.
6. Brown, J. B., Fryer, M. P., and McDowell, F. Internal wire-pin stabilization for middle third facial fractures. *Surg., Gynec. & Obst.* **93**:676-681, 1951.
7. Dingman, R. O. Use of rubber bands in treatment of fractures of bones of face and jaws. *J. Am. Dent. A.* **26**:173-183, 1947.
8. Brown, J. B., and Cannon, B. Repair of major facial injuries. *Ann. Surg.* **126**:624-632, 1947.
9. Adams, W. M. Internal wiring fixation of facial fractures. *Surgery* **12**:523-540, 1942.
10. Kazanjian, V. H. Primary care of injuries of face and jaws. *Surg., Gynec. & Obst.* **72**:431-436, 1941.

Additional References

Barsky, A. J. *Principles and Practice of Plastic Surgery.* 499 pp. Baltimore: Williams & Wilkins, 1950.
A discussion of facial injuries with a carefully selected bibliography of the important literature on fractures of the facial bone appended.

Blair, V. P., Brown, J. B., and Byars, L. T. Treatment of fracture of upper jaw. *Surgery* **1**:748-760, 1937.
A clear, concise presentation of the fracture patterns encountered following severe injuries to the face with an exposition of the principles involved in their management.

Erich, J. B., and Austin, L. T. *Traumatic Injuries of Facial Bones.* 600 pp. Philadelphia: Saunders, 1944.
An extremely well illustrated atlas using models of the skull to demonstrate methods of reduction and splinting of practically every type of fracture of the bones of the face and jaws.

Erich, J. B. Treatment of bilateral fractures of edentulous mandible. *Plast. & Reconstruct. Surg.* **9**:33-41, 1952.
A detailed elaboration of a specific problem of fracture splinting.

Fry, W. K., et al. *The Dental Treatment of Maxillo-Facial Injuries.* 434 pp. Philadelphia: Lippincott, 1945.
A general review of the multiple problems of facial injury with emphasis on the important part the dental surgeon can play in the management of the jaw fractures.

Kazanjian, V. H., and Converse, J. M. *The Surgical Treatment of Facial Injuries.* 574 pp. Baltimore: Williams & Wilkins, 1949.
An exhaustive review of many years of experience in the early and late treatment of facial injuries.

MEDICAL INTELLIGENCE

PULMONARY EMBOLISM COMPLICATING TRYPSIN THERAPY

Bert Seligman, M.D.*

TOLEDO, OHIO

THE therapeutic use of trypsin in acute inflammation with rapid subsidence of the process, and the later thrombolytic changes that it produces, has been extensively and admirably studied and discussed by Innerfield, Angrist and Schwarz.† This paper mentions that pulmonary emboli did not develop in any of the patients with thrombophlebitis treated with trypsin. The thought that trypsin, by initiating a fibrinolytic reaction, would prevent embolization was an interesting one, but short lived. In the following case of iliofemoral thrombophlebitis on the left, pulmonary embolism occurred during trypsin therapy.

Case Report

R. W., a 40-year-old man, was admitted to the hospital on September 10, 1953, with an acute left iliofemoral thrombophlebitis of 7 days' duration. He had pain in the entire lower extremity, calf tenderness, a positive Homans' sign, tenderness in the groin, a ++ edema of the foot and leg and prominent veins on the anterior tibial surface, with bilateral ankle pigmentation.

He had had a phlebitic process in the left leg about 1 year previously and had had 2 episodes in the right leg more than 1 year before admission.

The temperature was 101°F., the pulse 120, and the respirations 28.

The patient was placed on absolute bed rest, with the bed elevated at the foot 8 cm. on blocks; an anticoagulant and prophylactic sulfonamide were started, and daily soap-and-water foot wash, followed by alcohol and application of an antifungal ointment to control a tinea-pedis infection, was ordered.

Within 24 hours the prothrombin was 34 per cent, and for the next 10 days it was approximately 30 per cent. The patient was placed on procaine penicillin, 800,000 units daily, the drug being discontinued after 6 days owing to a generalized urticaria. The anticoagulant was administered as indicated by the prothrombin time. On September 17 clinical improvement was so great that the left leg was wrapped from the toes to the knees with a 10-cm. Ace rubber bandage, and the patient was allowed to walk. The temperature, pulse and respirations were almost normal on September 20, when the temperature rose to 99.6°F., with calf and groin tenderness present almost to the same degree as on admission; 10 mg. of trypsin‡ was dissolved in 250 cc. of distilled water with 5 per cent glucose and given intravenously, 60 drops per minute. Tripelennamine, 50 mg., was given about 10 minutes before the infusion was started. A 2d infusion was given 6 hours later, and 2 were given for the next 2 days, none on September 23, and 2 on September 24. The last infusion was

*Senior surgeon for vascular surgery, Flower Hospital; active member, Division of Peripheral Vascular Surgery, Maumee Valley Hospital.

†Innerfield, I., Angrist, A., and Schwarz, A. Parenteral administration of trypsin: clinical effect in 538 patients. *J. A. M. A.* **152**:597-605, 1953.

‡Kindly supplied by Dr. G. J. Martin, of the National Drug Company, Philadelphia.

completed at 6:30 p.m. Four hours later, while listening to the radio the patient was seized with a sharp pain in the right side of the chest, which worsened with respiration, especially in the right lower portion. He was apprehensive, with a temperature of 102°F., pulse of 110 and respirations of 40. He was given meperidine hydrochloride, 100 mg., the anticoagulant, 1500 mg., and erythromycin, 500 mg. Eight hours later the temperature was 100°F., the pulse 90, and the respirations 20. The patient looked much more comfortable and felt much improved over the previous evening. The prothrombin was 23 per cent on September 26 and thereafter was maintained around 30 per cent.

X-ray examination about 12 hours after the onset of the chest pain was reported as showing probable pulmonary infarct on the right. The patient improved rapidly on the therapy outlined and was discharged on October 1.

Discussion

Interestingly enough, on September 21 another patient was admitted to the hospital with a pulmonary embolism on the right secondary to a superficial thrombophlebitis of the left great saphenous and superficial epigastric veins, with involvement by extension of the right superficial epigastric and great saphenous veins. This patient, a forty-year-old man, was given 10 mg. of trypsin in 5 per cent glucose, 250 cc. twice daily for four days, with complete subsidence of thoracic pain, which previously had been so severe that he was forced to sit up day and night.

In the report of Innerfield et al. none of the patients with thrombophlebitis treated with trypsin had pulmonary emboli. In the case reported above the pulmonary embolism developed during treatment with trypsin.

1118 Sylvania Avenue

DOCTORS AFIELD
Wilfred Thomason Grenfell

Harrison E. Kennard, M.D.*

Brookline, Massachusetts

WILFRED T. Grenfell was a British medical missionary who became famous for his extraordinary work in Newfoundland and Labrador, not only in medicine but also in various other types of service to the isolated communities of this barren region.

Born in England in 1865 of a family distinguished for its educators as well as for its fighting men, he was educated at the University of London, at Oxford, and at the London Hospital under Sir Frederic Treves. Well known both in London and at Oxford as a hardy athlete, he spent many of his early holidays cruising the rough waters off the English coast, he also started teaching Sunday school while still in hospital training.

*Instructor in surgery, Tufts College Medical School; assistant surgeon, Department of Hygiene, Harvard University.

In 1889, at the suggestion of Sir Frederic, Dr. Grenfell abandoned the possibility of working up to a lucrative practice in fashionable London and joined the Royal National Mission for Deep Sea Fishermen. He then cruised the North Sea for

Ellis

Dr. Wilfred Thomason Grenfell.

three years as a medical missionary among the 20,000 mariners of the fishing fleet, who followed the sea, winter and summer, with very little medical or religious service available. In cold and stormy weather the work was especially difficult and dangerous, and many fishermen were drowned each year.

In 1892, as an additional venture, the Royal National Mission sent the little 151-ton ketch *Albert* from England to Labrador as a hospital ship, with Dr. Grenfell in charge, to work with the fishermen of Newfoundland and Labrador. With a freeboard of only 3 feet, the *Albert* crossed the Atlantic in nineteen days.

At that time, hundreds of schooners and about 30,000 fishermen sailed north to Labrador from Newfoundland each year for the summer cod fishing. Also, several thousand Eskimos and Indians and a few permanent white settlers or "liveyeres" inhabited the coast of Labrador at all seasons.

There were no doctors or hospitals on that barren and stormy coast. Not a single lighthouse existed in Labrador, and most of the coast was entirely uncharted. A well equipped hospital ship with a skillful surgeon aboard was welcome indeed.

In the following year the *Albert* was sent out again from England, and two more doctors and two trained nurses were provided. A small hospital was opened that summer at Battle Harbor in Labrador. Dr. Grenfell cruised up to the northern Eskimo settlements, and his tiny hospital ship was one of the last to go south that fall. Crossing the straits of Belle Isle in a storm, the small vessel ran out of fuel. However, the resourceful doctor, by chopping up the wooden cabin top for fuel, made steam enough to reach a safe harbor.

The work of Dr. Grenfell's Mission in Newfoundland and Labrador grew rapidly through the years. He was soon very much impressed with the evils of the so-called truck system of trading. The merchants had taken advantage of the hard-working fishermen by overcharging them for supplies and underpaying them for fish and fur. Many of the people in the outlying districts never saw any cash the year round, and remained constantly in debt to the local trader. This led Dr. Grenfell to start a chain of small co-operative stores, run on a cash basis, with great economic benefit to the people.

As the Mission grew and required more financial aid, he raised money by lecturing widely in England, Canada and the United States, and by writing fifteen books about Labrador and his work and travels.

A certified master mariner, as well as a surgeon, Dr. Grenfell also served for many years as a justice of the peace for the Colony of Newfoundland; acting as preacher-physician he held many church services both on his hospital ships and ashore, and was widely known for his excellent sermons.

Owing to poverty and disease and the dangers of their climate and calling, many parents among the fisherman families died, leaving children with no provision for their upbringing. Dr. Grenfell therefore started an orphanage, which for many years has made useful citizens out of hundreds of unfortunate children who might otherwise have had no one to care for them.

Under his leadership, nonsectarian schools were begun. Formerly, there had been several small, denominational schools, one belonging to each church, in villages that were hardly able to support a single school; he also started circulating libraries.

Diseases caused by lack of vitamins were common — night blindness, scurvy, rickets and particularly beriberi. He combated these by education regarding proper diet. He started a large greenhouse, where cabbages and other vegetables could be planted in late winter and then sold at cost to the natives in early summer for transplantation to their gardens. The season was so short that vegetables could not reach maturity except by this early planting in a hothouse.

For meat, milk and traction, Dr. Grenfell imported from Lapland, in 1907, 300 reindeer, complete with Lapp herders, to live off the sparse vegetation of the barrens. The animals throve, winter and summer, and in a few years multiplied to over 1200. However, because of the excellence of the meat and the lack of fences, most of the animals were exterminated, and the reindeer project was finally abandoned.

The Mission introduced pigs, sheep, cattle and chickens wherever possible, and taught the canning of fish, meat and native berries. The orphanage was sometimes fed on home-canned polar-bear meat, which at times was cheap and plentiful.

In 1912 the English, American and Canadian branches of the Mission were united by the formation in New York of the International Grenfell Association, with Dr. Grenfell as superintendent. The Association now possesses a substantial endowment owing almost entirely to his influence.

During the early part of World War I, Dr. Grenfell served as a major in the Harvard Surgical Unit in France.

Because of the inspiring leadership of the Grenfell Mission, hundreds of volunteers, many of them college students, worked for little or no pay, many at their own expense, for the famous Mission in Labrador. Many outstanding specialists gave generously of their time during long visits to Grenfell hospitals. The two principal Grenfell hospitals were the very first in Newfoundland to be approved by the American College of Surgeons.

The establishment of a clothing store provided a great deal of needed clothing to the people, at low cost, particularly during the depths of the recent world depression. The Mission also helped the inhabitants by the purchase of hooked rugs, skin boots, carved ivory and so forth made in their homes. The Mission sold these products, without profit, mostly outside Labrador.

Dr. Grenfell made many perilous journeys by dog sled, his first winter travel amounting to over 1500 miles. In 1908 he nearly lost his life; accidentally adrift on an icepan overnight in freezing weather,

he kept warm by killing and skinning 3 of his 8 dogs. He then attracted attention by waving his shirt on a flag pole, which he had made by binding together the frozen, disarticulated legs of his dogs.

In 1909 he married Anna Elizabeth MacClanahan, of Chicago, who helped him enormously in his work with the Mission. They raised a fine family of three children at St. Anthony, Newfoundland, the principal Mission station.

Dr. Grenfell's Mission has always stood for useful, practical charity, an excellent example of which was the St. Anthony drydock in northern Newfoundland. Built in 1930 at a cost of $37,000, the gift of an anonymous donor, it has saved many a deserving skipper and sailor from financial ruin. Previously, the nearest drydock had been 300 miles to the south and many damaged ships had been lost because no nearer facilities were available.

In 1931, through the collaboration of Dr. Alexander Forbes, with the Mission, the previously uncharted northernmost 100 miles of Labrador, between Ungava Bay and the Atlantic Ocean, was carefully mapped by means of aerial photography.

Dr. Grenfell retired from active work in 1935, and died five years later of a heart attack at the age of seventy-five years. There are now, thirteen years after his death, 4 hospitals and 5 nursing stations in the North as a result of his work, as well as schools, an orphanage and many other public institutions. The work of the Grenfell Mission is being carried on and extended in the North today under the able leadership of his successor, Dr. Charles S. Curtis.

Dr. Grenfell was the recipient of many honors during his lifetime including, in 1907, the first honorary degree in medicine ever given by Oxford University. He was knighted by King George V of England, in 1927, becoming Sir Wilfred Thomason Grenfell, K.C.M.G.

Doctor, mariner, justice of the peace, author, lecturer and perfect gentleman, this amazing man is renowned for his extraordinary achievements and his unparalleled capacities.

1180 Beacon Street

CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

BENJAMIN CASTLEMAN, M.D., *Editor*
VIRGINIA W. TOWNE, *Assistant Editor*

CASE 40011

PRESENTATION OF CASE

A forty-year-old executive was referred to the hospital because a mediastinal mass had been discovered on a survey chest photofluorogram two weeks previously.

Thirteen years before admission the patient had recurrent pain in the right lower quadrant, occasionally associated with low-grade fever. After several months of recurrent episodes lasting only a few days, he was admitted to the hospital during an exacerbation, and an appendectomy was performed. The pathological diagnosis was "healing appendicitis." Exploration of the abdomen at the operation revealed no Meckel's diverticulum and no mesenteric lymphadenopathy. A barium-enema examination before operation was negative; calcification of several mesenteric lymph nodes was seen. Abdominal pain was relieved and did not recur. Nine months later the patient was seen because of persistent afternoon fever and weakness for three months after an illness resembling infectious mononucleosis. The blood Hinton test and heterophil-antibody reaction were negative. An x-ray film of the chest was reported as normal. Tuberculous mesenteric lymphadenitis was suspected, and he was advised to give up his job managing a large gasoline station. He did this and after five months was symptom free. Three years later he was seen for a routine examination, and on fluoroscopy a prominent pulsating bulge was noted along the arch of the aorta; the measurements of the chest were 34 cm. transverse, 13 cm. apical and 9 cm. at the base. One year later he returned for examination, complaining of feeling tired and having no ambition; he said he coughed frequently and had sweats. His physician had suspected whooping cough; examination again showed low-grade fever but no abnormal physical signs except the pulsating mass at the left cardiac border; however, this had not changed on fluoroscopic examination.

He had had frequent colds, each following the same pattern. There was a temperature of 102°F. on the first day that subsided on the next day, when profuse nasal discharge, vague aches and pains, sore throat and infraorbital pain became prominent and persisted for three or four days. A tonsillectomy five years before admission apparently did not alter the frequency of colds, which ceased, however, three years later. At this time a hacking nonproductive cough appeared that was related by the patient to cigarette smoking. The cough persisted to the present admission.

Physical examination revealed a well developed and well nourished man who did not appear ill. No abnormalities were noted.

The temperature was 99°F., the pulse 74, and the respirations 20. The blood pressure was 120 systolic, 70 diastolic.

Urinalysis was negative. The hemoglobin was 11 gm. per 100 cc., and the white-cell count 12,700, with 78 per cent neutrophils, 18 per cent lymphocytes and 4 per cent young neutrophils. The sedimentation rate was 53 mm. in one hour. An electrocardiogram was within normal limits. An x-ray film of the chest showed clear lung fields. The heart was normal in size. Superimposed on the region of the main pulmonary artery was a 5-cm. soft-tissue mass that could not be separated from the heart (Fig. 1). This mass pulsated with the pulmonary artery and aorta, and seemed to decrease in size with the Valsalva maneuver. The hilar vessels were not remarkable. An arteriogram with 70 per cent Diodrast introduced into the deep veins of the right arm demonstrated good filling of the normal-appearing right and left sides of the heart, the mediastinal shadow appearing definitely dissociated from both pulmonary and systemic vessels. Tuberculin skin tests with 1:100,000 and 1:10,000 dilutions of old tuberculin each showed a 3-mm. area of erythema without induration at the end of twenty-four and forty-eight hours.

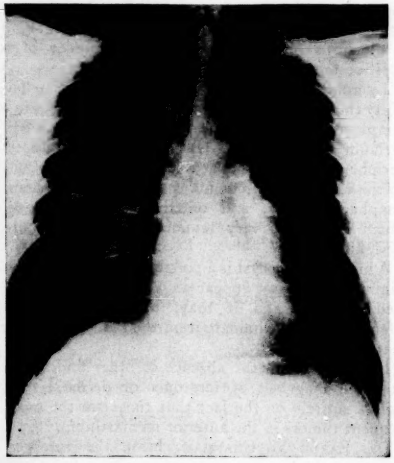

FIGURE 1.

The patient remained asymptomatic but had a daily afternoon rise in temperature varying from 99 to 100°F., with a morning temperature of 98°F. For a week 1 gm. of streptomycin was given intramuscularly each day, and the temperature fluctuations were slightly reduced. On the sixteenth hospital day an operation was performed.

DIFFERENTIAL DIAGNOSIS

DR. LEWIS W. KANE*: In summary this forty-year-old man had a long history of being below par. Thirteen years before admission, because of recurrent abdominal pains and fever, an appendectomy was performed. Nine months later, when the fever recurred and calcification was noted in the abdomen on x-ray examination, a diagnosis of tuberculous mesenteric adenitis was suspected. At that time x-ray films of the chest were normal. Nine years before admission, when he was thirty-one years of age, a fluoroscopy that was performed as a part of the routine examination showed a mass along the arch of the aorta, and the next year the mass was again seen. Apparently, he consulted his physician then because of fatigue, cough and a slight fever. Two weeks before admission x-ray films of the chest demonstrated the same mass that had been described before; on admission the main findings were anemia, elevation of the sedimentation rate, fever and leukocytosis.

In the diagnosis of mediastinal masses, the most important aid is to determine in what part of the mediastinum the mass is located. I might start by seeing the x-ray films.

DR. JOSEPH HANELIN: The last films of the chest show the abnormal mediastinal outline. The mediastinum is widened toward the left and has a somewhat lobulated contour superiorly. The mass is situated anteriorly, and is closely attached to the great vessels and anterior surface of the heart (Fig. 1). The lungs are clear. There probably is no actual increase in the transverse measurement of the heart, and there is nothing to indicate asymmetrical chamber enlargement. To determine the exact relation of the density to the great vessels and the heart an angiocardiogram was done, demonstrating that it is separate from these structures.

DR. KANE: Is the mass cystic?

DR. HANELIN: It is impossible for us to determine wholly on the basis of configuration whether a mass is cystic or not. Generally, a fluid-filled cyst tends to be spherical, but that is not always true; it may at times have a lobulated contour. The configuration of this mass, however, favors a solid tumor.

DR. HELEN S. PITTMAN: Would the Valsalva maneuver be helpful?

DR. HANELIN: The Valsalva maneuver may be difficult to evaluate. If the tumor is an aneurysm it should diminish in size with the effect; however, a very vascular tumor might similarly show some reduction in its mass.

DR. KANE: Is there calcification within the mass?

DR. HANELIN: No; the mass is homogeneous.

*Assistant in medicine, Massachusetts General Hospital.

DR. KANE: Do you know whether it moved with swallowing?

DR. HANELIN: There is no mention of it in the record; I did not examine the patient myself. It was noted to pulsate synchronously with the great vessels to which it was adjacent; however, it is not usually possible to differentiate intrinsic from transmitted pulsations. These angiograms, which were made approximately every three quarters of a second by a rapid serial process, demonstrate the filling of the superior vena cava, right atrium, right ventricle and right and left branches of the pulmonary artery. On the film in which the pulmonary artery is very well filled the density is totally separate from these structures; when the left ventricle and atrium are filled, the mass is also shown to be distinct from them.

DR. KANE: Anteriorly situated?

DR. HANELIN: That is correct; and more to the left. I think we can be quite sure of its position in the anterior mediastinum. It lies close to the vessels and pericardium; I cannot define its posterior margin.

DR. KANE: It is not near the carina?

DR. HANELIN: No; it is definitely removed from the carina.

DR. KANE: The mass is in the anterior mediastinum and apparently not related to the vascular structures of the mediastinum, which makes its diagnosis somewhat easier. At least on that basis I can eliminate the tumors of neurogenic origin. In a review of 233 mediastinal tumors of neurogenic origin[1] it was found that only 2 occupied a position in the anterior mediastinum. The most common tumors in the anterior mediastinum are the dermoid cysts and teratomas, and although they are found in the anterior mediastinum, at times they project into the thorax on the left or right side as the mass seen in these x-ray films does. These tumors remain for many years in a latent state and then increase in size at the time of adolescence or early adult life, when they may cause pressure symptoms such as cough, pain in the chest and engorgement of the venous return from the head. In the majority of cases the tumors are discovered between the ages of twenty and thirty. If infection occurs within them, some of the symptoms and signs that this man had can be produced — the anemia, fever, elevation of the sedimentation rate and leukocytosis. It is impossible from the clinical point of view to be certain that we are dealing with a teratoma as opposed to a dermoid, because in certain cases an overlap occurs even histologically. I believe, entirely on the basis of its being the most common tumor in the anterior mediastinum, that the diagnosis in this case is a dermoid cyst or teratoma. In the absence of any teeth or bone visible in the x-ray films, however, I cannot be certain of this.

There are a great many other possibilities that should be discussed, among which is thymoma. Seventy-five per cent of the cases of thymoma are associated with myasthenia gravis, and in its absence I am unable to make a diagnosis of thymoma, although I should not be surprised if it were present.

A tuberculoma, of course, must be considered, for several reasons. I am told that a diagnosis of tuberculous mesenteric adenitis had been suspected, and the patient received streptomycin before operation. Tuberculoma of the mediastinum is a rare condition. Up to 1951 only about 14 cases had been reported.[2] It is of interest that 10 of these occurred in patients below the age of twenty. In 10 cases the tuberculoma was found on the right side of the mediastinum in the crotch formed by the junction of the azygos vein and the superior vena cava. It is also of interest that the tuberculin test was negative in some cases. Such a diagnosis is suggested on the basis of the elevation in temperature, the chronic course, the anemia and the elevation in the sedimentation rate. However, I am disturbed by the negative tuberculin test and am opposed to making a diagnosis of tuberculosis in the absence of a positive test.

Lymphoma of the Hodgkin type is another possibility that I do not know how to eliminate. Hodgkin's lymphoma limited to the superior anterior mediastinum is uncommon. In a series of 90 cases[3] peripheral lymphadenopathy was absent in only 1. In the case under discussion there was no peripheral lymphadenopathy, and on that evidence alone, which I know is very tenuous, I shall eliminate Hodgkin's disease.

A bronchogenic cyst is a possibility that we cannot eliminate. It may appear as a solid mass in the mediastinum — and it may, of course, become infected. I shall eliminate it on the basis of the fact that it is rare.

In summary, in the absence of other findings, I base the diagnosis of teratoma or dermoid cyst almost entirely on the fact that these are the most frequent tumors in the anterior mediastinum.

DR. EARLE M. CHAPMAN: I am the one who fluoroscoped the patient and saw him on many occasions. I thought this was tuberculosis and that originally he had tabes mesenterica. When he had the appendectomy, lymph nodes were not discovered, but the x-ray films showed calcified nodes in the abdomen and he had fever, fatigue and sweats that were consistent with tuberculous adenitis. On bed rest and good care, he got over this episode, as one would expect with tuberculous adenitis.

Later, when he entered the hospital because of the mass found on the routine chest film, I associated the two and still believed he had tuberculosis. I stayed the hands of the surgeon until we saw what effect the streptomycin would have. The antibiotic was given for only one week, during which I think the temperature was somewhat lower; yet there was no evidence that the size of the tumor was shrinking.

He had been on bed rest for three weeks before operation.

DR. BENJAMIN CASTLEMAN: Dr. Pittman, have you any comment?

DR. PITTMAN: I do not think tuberculoma occurs as centrally as this; I think it would have to have been tuberculous mediastinal lymph nodes.

DR. JOHN T. QUINBY: The anemia — hemoglobin of 11 gm. per 100 cc. — might readily be explained by an infection of the dermoid or teratoma.

DR. PITTMAN: I think that is not too significant. The anemia may possibly point more to Hodgkin's disease, but I do not think we can rule out secondary infection in any other process.

DR. CHAPMAN: Do you think the mass would have grown in size as much as this if it had been a dermoid? Do not dermoids and teratomas tend to remain the same size after the age of thirty?

DR. CASTLEMAN: That is true, unless they become malignant or infected.

DR. CHAPMAN: When I first saw the mass on fluoroscopy, it was much smaller than it was in the last x-ray films.

DR. PITTMAN: So you think it is more likely to have been Hodgkin's disease?

DR. CHAPMAN: No; I favored tuberculosis.

DR. ALLEN G. BRAILEY: The occurrence and persistence of a slight fever are not likely to be present on the basis of tuberculosis over ten years' time.

DR. CASTLEMAN: Dr. Cass, have you a suggestion?

DR. JOHN W. CASS: I should consider lymphoma from the clinical story.

CLINICAL DIAGNOSIS

Mediastinal tuberculosis.

DR. LEWIS W. KANE'S DIAGNOSIS

Dermoid cyst or teratoma of mediastinum.

ANATOMICAL DIAGNOSIS

Hyperplasia of mediastinal lymph nodes.

PATHOLOGICAL DISCUSSION

DR. CASTLEMAN: Dr. Richard H. Sweet, who operated on this patient, found a large mass just to the left of the midline that lay over, but was not adherent to, the left pulmonary artery and left side of the heart. Along with this mass was a large group of hypertrophied lymph nodes. The mass and the nodes were excised en bloc. At the time of operation the surgeon thought that he was dealing with a thymoma with lymph-node metastases. When sectioned both the large mass and the satellite nodes had the soft, pink appearance of lymph nodes (Fig. 2), and this was confirmed on microscopical examination. They were composed of lymphoid tissue, hyperplastic to be sure, with many germinal centers surrounded by mature lymphocytes. Many of these germinal centers contained hyalinized foci, which were not the Hassall corpuscles found in thymic tissue. There were many plasma cells scattered through the lymphoid tissue, another bit of evidence that these were inflammatory or reactive lymph

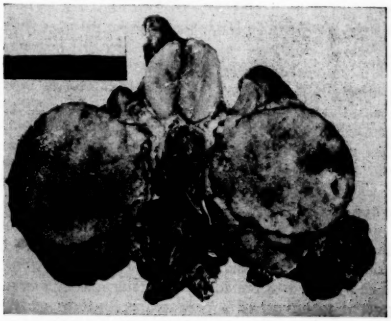

FIGURE 2. *Photograph of the Mass of Mediastinal Lymph Nodes, Showing Two Large Lymph Nodes Bisected.*

nodes, similar to hyperplastic nodes seen in other parts of the body. It is certainly unusual that these nodes remained so large for so long a time. We have recently had another case of a mass close to a bronchus that had been observed roentgenologically for five years and was believed before operation to be a bronchogenic cyst. This also proved to be a large hyperplastic lymph node. In the past some of these hyalinized centers of lymphoid follicles have been interpreted as abortive Hassall corpuscles and therefore have been incorrectly reported as thymomas.[4] I had occasion recently to review the material on thymomas and other mediastinal tumors at the Armed Forces Institute of Pathology and found 4 similar cases. They are not thymomas and have nothing to do with the thymus; they are almost always to the right or left of the midline, often close to a bronchus or lung.

DR. CHESTER M. JONES: And they never calcify!

DR. CASTLEMAN: The ones I have seen had no foci of calcification.

DR. CHAPMAN: This is a new disease syndrome that you are presenting to us!

DR. CASTLEMAN: Some of these cases have been shown to a number of pathologists, including Dr. Philip Custer, Dr. Hans F. Smetana and Dr. Frederic Parker, Jr., who are experts on lymph nodes, and they all agree that they are hyperplastic lymph nodes with reactive germinal centers and not thymomas.

DR. CHAPMAN: Do you think there is any chance that this disease might recur?

DR. CASTLEMAN: I do not think so; it has not in the other cases.

DR. BRAILEY: Do you know how the patient is now?

DR. CHAPMAN: It is now ten months after the operation, and this man is very well; he is playing golf and is working hard.

REFERENCES

1. Blades, B. Mediastinal tumors: report of cases treated at Army thoracic surgery centers in United States. *Ann. Surg.* **123**:749-765, 1946.
2. Storey, C. F., and Lyons, H. A. Tuberculomas of mediastinum. *Am. Rev. Tuberc.* **64**:327-352, 1951.
3. Jackson, H., Jr., and Parker, F., Jr. *Hodgkin's Disease and Allied Disorders*. 177 pp. New York: Oxford, 1947.
4. Crane, A. R., and Carrigan, P. T. Primary subpleural intrapulmonic thymoma. *J. Thoracic Surg.* **25**:600-605, 1953.

CASE 40012

PRESENTATION OF CASE

A forty-one-year-old bookkeeper was transferred to this hospital in coma.

Ten years before admission, the patient was reported to have had a paranoid episode in which she believed people were talking about her behind her back. She recovered from this spontaneously. Six weeks before admission she again began to have ideas of reference. One week later she complained of "numbness" and weakness of the left leg, and, to a lesser extent, of the left arm. The weakness gradually progressed until, about ten days before admission, she had great difficulty in walking. The night before admission she entered a sanatorium and was given an electric-shock treatment. She apparently made a satisfactory recovery immediately after the treatment, but two and a half hours later she "gave a cry and fell back in bed unconscious," whereupon she was found to have a flaccid left hemiplegia. Ten hours later she was transferred to this hospital for investigation.

The general physical examination was negative. On neurologic examination she was comatose but made purposeful attempts to avoid painful stimuli. There was slight bilateral papilledema. The pupils were small, and the right was larger than the left. There was a severe left hemiparesis. The left plantar reflex was extensor, and the right was equivocal.

The temperature was 101°F., the pulse 50, and the respirations 25. The blood pressure was 104 systolic, 60 diastolic.

The urine had a specific gravity of 1.028 and gave an olive reduction to Benedict's test. Repeated urine examinations revealed a green reduction. Examination of the blood revealed a white-cell count of 22,100 and a hemoglobin of 13.8 gm. per 100 cc. The sodium was 135 milliequiv., and the potassium 4.2 milliequiv. per liter, and the fasting blood sugar 176 mg. and the nonprotein nitrogen 31 mg. per 100 cc. On lumbar puncture the spinal fluid, which was under an initial pressure equivalent to 360 mm. of water, was faintly xanthochromic and contained 71,000 red cells and 147 white cells per cubic millimeter and a total protein of 356 mg. per 100 cc.

Roentgenograms of the skull revealed upward displacement of the pineal body. A right carotid arteriogram was interpreted as showing normal findings except that the pattern of the anterior cerebral group suggested internal hydrocephalus. Then the right lateral ventricle was tapped through a right parietal burr hole, and clear fluid under increased pressure was removed. Ventriculograms demonstrated symmetrical enlargement of the lateral ventricles, dilatation and upward displacement of the third ventricle and posterior displacement of the aqueduct and fourth ventricle.

After the ventricular tap the patient's state of consciousness improved slightly so that she could carry out a few simple commands. At this time, and on the second hospital day, neurologic examination showed the eyes to be fixed in the primary position, with small fixed pupils (now equal); there were weakness and hypalgesia on the right side of the face, with diminished right corneal reflex; left hemiparesis persisted, and it was thought that there was decreased pain sensation on the left side, with sparing of the face. An electroencephalogram on the third hospital day disclosed an abnormal record with alternations of runs of delta with alpha and theta frequencies. Delta activity was greatest at the left frontal and left mid-temporal electrodes. On the sixth hospital day an ophthalmologist found anesthesia of the right cornea and possible hypesthesia of the left cornea, no horizontal movements of the eyes and unsustained vertical movements limited to 10° to 15°, and vertical divergence of the eyes on attempted downward gaze, with the left eye relatively elevated. The pupils were equal at 3 mm., with a minimal reaction to light. There was bilateral ptosis and exotropia. Later that day a seizure occurred, with drawing of the mouth to the left and with twitching of the mouth. The pupils were dilated, and the pulse unobtainable. No movements of the limbs were seen. The subsequent hospital course of two and a half months was complicated by a urinary infection with *Proteus vulgaris* and *Escherichia coli* and by conjunctivitis and chemosis. The neurologic state remained unchanged except that bilateral extensor plantar reflexes and ankle clonus were present after about two or three weeks. The state of consciousness varied between ability to respond by simple movement to command and a semicomatose state. Repeated lumbar punctures revealed high initial spinal-fluid pressures ranging from the equivalent of 410 to 470 mm. of water, clear fluid and total protein levels from 26 mg. to 55 mg. per 100 cc. On the forty-fifth hospital day the patient was found cyanotic with cold, clammy extremities, respirations of 36 and a pulse of 140. The blood pressure was 140 systolic, 80 diastolic. She was completely unresponsive and areflexic.

There was now marked papilledema on the left; the right fundus could not be visualized. Ventricular tap revealed clear spinal fluid under increased pressure. She improved slightly after the tap but eleven hours later was again found unresponsive and areflexic. The blood pressure was unobtainable; the pulse was 110, and the temperature 106°F. Guaiac-positive material was found on the tip of the stomach tube. She died half an hour later.

Differential Diagnosis

Dr. William H. Timberlake*: The paranoid episode ten years before admission gives me a clue to the patient's personality bent. The recurrence of such ideas six weeks before admission may have represented her reaction to symptoms so vague that she could not formulate a specific complaint about them until the next week, but they more probably resulted from nonspecific interference with thought processes because of increased intracranial pressure.

Gradually increasing weakness of the left arm and leg clearly implies a progressive lesion somewhere along the right corticospinal tract. I do not believe that the interval of "satisfactory recovery" for two and a half hours necessarily exonerates the electroshock therapy from playing some part in the subsequent course of events.

In addition to the more common cardiac complications causing death in a few hours or days, and the infrequent fatal cerebral fat embolism from fractures sustained during treatment, autopsy in cases of death after electroshock therapy has disclosed intracranial disease in the form of cerebral edema with medullary compression or petechial hemorrhages. In 1 case thrombosis of venous sinuses and large veins, with subsequent subarachnoid and subdural hemorrhage, became clinically manifest two days after electroshock therapy. However, in the case under discussion progressive hemiparesis preceded electroshock therapy, and so I must think rather in terms of a pathologic process antedating, rather than caused by, electroshock therapy.

The cry that the patient gave before collapsing suggests a painful process such as suddenly increased intracranial pressure, perhaps with hemorrhage. The hemiparesis increased, as one would expect. It was not stated whether the neck resisted forward flexion on the examination. It may take a day or so for this sign to develop in subarachnoid hemorrhage, and coma may mask it. This patient responded to other painful stimuli. The record does not say whether this response was elicited in all parts of the body.

There was slight papilledema, indicating increased intracranial pressure. Subarachnoid hemorrhage may cause papilledema in four hours. It is then usually a severe process, with hemorrhages around the disk. This is not a decisive point, but in view of later developments may indicate that increased intracranial pressure antedated the patient's coma.

*Assistant in neurology, Massachusetts General Hospital.

Without knowing the course of the pupillary changes, one cannot judge which pupil was the more abnormal. The left may have been more constricted because the parasympathetic fibers in the third nerves were being irritated or because sympathetic control via the brain stem had been abolished. The right may have been less constricted because its parasympathetic innervation was partially paralyzed. Although the lumbar puncture disclosed subarachnoid hemorrhage, there is no mention of ptosis or other paralysis of extraocular movements to indicate that the dilated right pupil resulted from damage to the third nerve by an aneurysm of the right internal carotid or posterior cerebral artery that might have ruptured into the right cerebral hemisphere to cause the hemiparesis. Indeed, the gradual onset of hemiparesis before the acute episode is strongly against that possibility. A tumor of the right hemisphere that bled could cause the picture so far, the equivocal right plantar response being due to pressure of the brain stem against the tentorium. One must remember, however, that the corticospinal tract extends beyond the internal capsule, and in the brain stem the corticospinal tracts are so close together as to be easily implicated by a single lesion. The upward displacement of the pineal body indicates that this lesion lay in the brain stem.

Although the negative arteriogram through the right carotid artery does not rule out aneurysm of the vessels it filled, this arteriogram suggested hydrocephalus rather than subcortical clot. Evidently, the brain-stem lesion blocked cerebrospinal-fluid circulation.

Blood from ruptured aneurysms of the posterior part of the circle of Willis sometimes refluxes through the apertures of the fourth ventricle into the ventricular system but did not do so in several of the cases in our series in which there was more blood in the spinal fluid than in this case and yet no obstruction was found at autopsy. The improvement that followed the ventricular tap also suggests that the hydrocephalus was of the noncommunicating type.

By ventriculogram a space-taking lesion ventral to the aqueduct and fourth ventricle was seen. May I see the x-ray films?

Dr. John F. Gibbons: This selected lateral plain film shows the upward displacement of the faintly calcified pineal gland. The air studies demonstrate bilateral enlargement of the lateral ventricles — evidence of internal hydrocephalus suggested on the otherwise negative angiograms; in two selected lateral views the posterior portion of the third ventricle is elevated,—the anterior part of it being at the usual level,—and the floor of the ventricle bows upward. The fourth ventricle is displaced posteriorly, and its anterior portion is also compressed in a rounded manner, as is the aqueduct. There is very little difference in enlargement on either side of the lateral ventricles. Incidentally,

about the only lateralizing clue is that the third ventricle is displaced slightly to the right side. The findings suggest a space-taking lesion lying in the region of the brain stem.

DR. TIMBERLAKE: The patient became more responsive and was re-examined. Both pupils were small, as is often seen in pontine lesions, presumably because of interruption of sympathetic pathways down to the spinal cord. The patient's eyes were fixed in the primary position, which implies paralysis of voluntary lateral gaze but does not necessarily indicate paralysis of upward gaze, which is a more difficult movement to accomplish than lateral gaze. In a patient in this state of poor responsiveness I should not be willing to attach much significance to the inability to look upward, particularly since upward movement was later elicited although it was poorly sustained. It might have been instructive to know the effect of stimulation of lower reflex controls of eye movement. The use of vertical opticokinetic stimulation to evoke vertical eye movements might have shown that midbrain eye "centers" were functioning then as they clearly were a little later. By rotation of the head or particularly by caloric stimulation of the labyrinths impulses might have been sent in, perhaps immediately below the lesion, to the "centers" for conjugate gaze; if the disturbance had been unilateral the eyes would then have been turned to one side.

The crossed hemiplegia and hemianalgesia further confirm the pontine level of the lesion.

In skew deviation the eye on the side of the lesion moves downward, and the opposite eye moves upward. In rabbits experimentally produced lesions of the vestibular nuclei and their connections to the ocular nuclei can cause this. However, rabbits have laterally directed eyes that under normal circumstances can have skew deviation, so perhaps this finding cannot be strictly applied to man. I cannot use it to help me with the localization. With the appearance of bilateral ptosis and exotropia I suspect an upward herniation through the tentorium paralyzing the third nerves.

The electroencephalogram does not help me. Hydrocephalus alone is assumed not to be the cause of slowing in these circumstances; presumably what happens is that there is a disturbance in function in the upper midbrain, perhaps owing to disturbance in the circulation there. Even with such a lesion the slow activity may be asymmetrical and in a few cases may be maximal on the contralateral side.

Seizures occur in brain-stem lesions and are usually attributed to indirect mechanisms consequent on the hydrocephalus present in most cases. In the case under discussion the movement of the face was described as "twitching" not as "clonic movement"; moreover, the arm and leg were not involved so it may be that these were not seizures of cortical origin but rather were due to irritative phenomena at the pontine level affecting the seventh-nerve nucleus.

Subarachnoid hemorrhage sometimes causes glycosuria in nondiabetic patients. However, the blood sugar was elevated, indicating that the patient may have had diabetes. In diabetic patients atherosclerosis occurs early; one might think that the early hemiparesis in this patient may have been due to pressure against the pyramidal tract by an enlarged atherosclerotic aneurysm of the basilar artery. Such a lesion would be the most likely to cause such pressure without changes in the cerebrospinal-fluid protein — which in this case was normal after the hemorrhage had cleared. However, fusiform atherosclerotic aneurysms do not often bleed; usually, if there is a rupture, there is an associated "congenital" aneurysm. Rather than bring in two diagnoses I suspect that a large congenital aneurysm of the basilar artery ruptured, blood going into the right side of the pons. The previous hemiparesis, which gradually increased, was due to direct pressure against the pyramidal tract. Evidently, no further bleeding into the subarachnoid space occurred after that one episode. Intramedullary restriction of further bleeding is a possible explanation of the later symptoms, but is less likely than thrombotic incidents or the effect of increasing hydrocephalus. The fact that the symptoms remained relatively constant until the terminal episode also suggests something like an aneurysm.

Hemorrhages, intramedullary and subarachnoid, also occur from angiomas of the brain stem. These may long remain asymptomatic and then may lead to a rapidly fatal chain of events. Pregnancy and trauma are not uncommon provocations in bringing to light brain-stem tumors, particularly angiomas, as Harvey Cushing pointed out. Although an angioma may have been the lesion, I lean away from it because of the early left-sided signs.

Gliomas of the pons may infiltrate, causing surprisingly few early local symptoms, and may bleed; the blood can get into the subarachnoid space. They can cause hydrocephalus and are often associated with a normal cerebrospinal-fluid protein. I cannot exclude this possibility, but I think it is less likely.

Metastatic brain tumors tend to bleed, but localization in the brain stem is so unlikely that I shall ignore the hint about guaiac-positive material on the tip of the stomach tube and assume that it was due to erosion by the tube rather than bleeding from a tumor. I should not even care to involve an ulcer of central origin.

The terminal event, as indicated by the improvement after ventricular tap, was due to advance of the hydrocephalus, with pressure-cone formation resulting in the changes in the vital signs and the "spinal-shock" type of areflexia.

DR. JAMES B. AYER: I believe the location of brain disease that Dr. Timberlake indicated is

correct — that is, the brain stem. But I doubt if it was aneurysm for two reasons: blood from a ruptured aneurysm should have spread upward into the ventricles, and it did not, indicating a fluid block in the aqueduct prior to rupture; and secondly aneurysms in this region are rare. I prefer to think of a pontine glioma that may have been present a long time and then showed urgent symptoms from growth or bleeding. Death was probably due to a posterior-fossa pressure cone. The relation of shock treatment to the hemorrhage is speculative.

Clinical Diagnosis

Angioma of pons, with hemorrhage.

Dr. William H. Timberlake's Diagnosis

Ruptured congenital aneurysm of basilar artery.

Anatomical Diagnosis

Glioblastoma multiforme of pons.

Pathological Discussion

Dr. Edward P. Richardson, Jr.: At autopsy there was a striking enlargement and distortion of the brain stem. The base of the pons and the right brachium pontis were greatly enlarged and had a peculiar irregular contour. The photograph (Fig. 1) shows the cross-section appearance of the lesion. The brain stem was diffusely infiltrated with neoplastic tissue in which there were numerous foci of necrosis and of old and recent hemorrhage. The tumor involved both sides but was considerably more extensive on the right, where it extended into the cerebellum via the middle cerebellar peduncle. The lateral ventricles were dilated — which would be expected from the constriction of the cerebral aqueduct. The tumor extended downward into the upper third of the medulla oblongata, and upward into the subthalamic and thalamic regions, particularly on the right side. Microscopically the tumor was an extremely anaplastic, undifferentiated glioma, which we classified as glioblastoma multiforme.

Figure 1. *Horizontal Sections of the Pons and Midbrain, Showing Extensively Infiltrating Glioblastoma Multiforme.*

ANNOUNCEMENT FOR GROUPS USING CASE RECORDS

The Massachusetts General Hospital wishes to announce that it has obtained a grant from the United States Public Health Service to supply pertinent 35-mm. lantern slides of x-ray films, gross photographs and photomicrographs to go along with the current Case Records to groups who use these exercises for teaching purposes.

It is planned to supply about 5 lantern slides with each issue of the *Journal* (2 cases) — that is, approximately 250 slides per year (these may be added to the teaching files of the group). The grant included the following conditions:

> "The project will be limited to 100 groups. The leader of each group should fill out an application stating the character and size of the group, how often it meets, and its methods of presentation of the Case Records. It is proposed that in order to limit the number of groups and to safeguard selection, each group pay a yearly stipend of $25.00. (The actual cost will be about $100.00.)"

Applications for this service may be obtained from Dr. Benjamin Castleman, Massachusetts General Hospital, Boston 14, Massachusetts.

The New England
Journal of Medicine

Official Organ of
THE MASSACHUSETTS MEDICAL SOCIETY
and
THE NEW HAMPSHIRE MEDICAL SOCIETY
OWNED BY THE MASSACHUSETTS MEDICAL SOCIETY AND
PUBLISHED WEEKLY UNDER THE JURISDICTION OF THE
COMMITTEE ON PUBLICATIONS

Richard M. Smith, M.D., *Chairman*
James P. O'Hare, M.D. — Conrad Wesselhoeft, M.D.
Oliver Cope, M.D. — Richard E. Alt, M.D.

Joseph Garland, M.D., EDITOR

ASSOCIATE EDITORS
Thomas H. Lanman, M.D. — Donald Munro, M.D.
Theodore H. Ingalls, M.D.

Clara D. Davies, EXECUTIVE EDITOR
Robert O'Leary, ASSISTANT EDITOR
James F. Ballard, BOOK REVIEW EDITOR
Milton C. Paige, Jr., BUSINESS MANAGER

EDITORIAL BOARD
C. Guy Lane, M.D. — Vernon P. Williams, M.D.
Henry R. Viets, M.D. — Benjamin Castleman, M.D.
Robert M. Green, M.D. — Hugh R. Leavell, M.D.
Dwight O'Hara, M.D. — J. Englebert Dunphy, M.D.
Fletcher H. Colby, M.D. — Robert W. Buck, M.D.
Robert L. Goodale, M.D. — Herrman L. Blumgart, M.D.
Chester M. Jones, M.D. — Frank N. Allan, M.D.
Harvey R. Morrison, M.D. — Harvey A. Kelly, M.D.
Maxwell Finland, M.D. — Langdon Parsons, M.D.
Deering G. Smith, M.D.*

*Representing the New Hampshire Medical Society.

SUBSCRIPTION TERMS: $8.00 per year in advance, postage paid, for the United States (first-year interns and medical students, $5.00 per year); Canada, $9.00 per year (Boston funds); foreign, $10.50 per year. Long-term rates: United States, 2 years $15.00, 3 years $22.00; Canada, 2 years $17.00, 3 years $25.00; foreign, 2 years $20.00, 3 years $29.50.

MICROFILM volumes available to regular subscribers through University Microfilms, 313 N. First Street, Ann Arbor, Michigan.

MATERIAL, other than original articles, should be received not later than noon on Thursday, three weeks before date of publication.

THE JOURNAL does not hold itself responsible for statements made by any contributor.

COMMUNICATIONS should be addressed to the *New England Journal of Medicine*, 8 Fenway, Boston 15, Massachusetts. Telephone KE 6-2094.

YORKSHIRE PRACTITIONER

COUNTLESS generations of general practitioners, never more successfully than now, have added luster to their particular branch of medical practice. No one of them, however, has upheld with greater distinction the dignity and prestige of the family doctor than has William Pickles, of Aysgarth, Yorkshire.

For many years the leading practitioner and district health officer of the Yorkshire dale in which lie the little villages of Aysgarth, Askrigg and Wensley, Will Pickles has almost literally, like the ship in the famous parable, let down his bucket into the resources that have surrounded him these forty-odd years. From this material he has drawn a knowledge of epidemic disease that has constituted a lasting contribution to medical learning. In regard to certain lines that he has quoted:

> Who goes gleaning
> Hedge-side chance blades, while full sheaved
> Stand cornfields by him,

it is obvious that he has neglected neither the cornfields nor the chance blades.

Dr. Pickles is known throughout the British Commonwealth for his writings and his lectures in Great Britain, Australia and South Africa. He is known best in the Boston area because of his Cutter Lecture on "Epidemiology in Country Practice," delivered under the auspices of the Harvard School of Public Health in 1948 and subsequently published in the *Journal* on September 16 of the same year. In this lecture he quoted, in addition to the above lines, that passage of Huxley's which, as his life-long motto, must have contributed to the interpretation of his patient observations. "Sit down before fact as a little child: be prepared to give up every preconceived notion; follow humbly and blindly wherever Nature leads or you shall learn nothing."

Holding an honorary degree of doctor of science from the University of Leeds, the recipient last October of the Bisset Hawkins Medal of the Royal College of Physicians "awarded triennially to a Medical Practitioner who is a British subject and who has during the preceding ten years done such work in advancing Sanitary Science or in promoting Public Health as, in the opinion of the College, deserves special recognition," new laurels have now come to rest on Will Pickles's imperturbable brow. For on November 14, at the first annual general meeting of the new College of General Practitioners held in the Great Hall at B.M.A. House, he was installed as the College's first president.

On this occasion he was presented by the Greek ambassador with a gavel made from an ancient plane tree on the Island of Cos. Whether this was the same tree under which Hippocrates sat with his pupils the ambassador did not say, but it is certain that the recipient of this symbol of authority will wield it with something like Hippocratic distinction, as well as with Hippocratic moderation.

ALCOHOLIC BEVERAGES

It is of interest to turn occasionally from the usual consideration of the gastronomic and social aspects of alcohol consumption to a contemplation of its position in the world of industry. Recently the American Business Men's Research Foundation, a nonprofit organization for business research, issued some figures regarding the personal consumption, expenditures and costs of various items in the national life. These figures for 1951 were as follows: alcoholic beverages, $9,150,000,000; meat, $11,500,000,000; milk and dairy products, $8,000,000,000; tobacco, $4,703,000,000; bakery goods, $2,957,113,000; and soft drinks, $1,200,000,000.

Referring further to the increase in consumption in the eighteen-year period since prohibition ended, the report states that there was an increase of 162 per cent in consumption of beverage alcohol from 1934 to 1952. Beer consumption increased 115 per cent and wine consumption 507 per cent; whiskey with its minor relations, brandy, rum and gin, has increased 203 per cent, though it is of interest that in the period from 1946 to 1952 there has been a drop in the per capita consumption from 1.39 gallons to exactly 1 gallon in the latter year. The figures for really big business, such as the automotive industry ($18,415,000,000), housing ($21,765,000,000) and clothing and repairs ($18,455,000,000), run much higher, though the total consumption figure for alcoholic beverages is impressive, exceeding the figure for milk and related products and being more than three times that of all bread and bakery goods.

As these data, emphasizing the bigness of alcohol as a business, were being reviewed, a reprint discussing another phase of the alcohol question — that is, the terminal stage of alcohol consumption — appeared.* This was a study of the records and information gained from the families of 500 deceased alcoholics. The average longevity was fifty-two years; 16 per cent lived to the age of seventy-five or over, and 12 per cent died under the age of forty. Directly or indirectly 28 per cent died from the effect of alcohol through violence or illness. In 29 per cent the drinking continued throughout their lifetimes. About 22 per cent stopped drinking during prolonged terminal illness. In 10 per cent the drinking gradually became more moderate until at the time of death alcoholism had not been a serious problem for many years. Eleven per cent stopped drinking permanently (exclusive of a terminal illness), and 8 per cent stopped for three years or longer, only to relapse at a later date.

*Lemere, F. What happens to alcoholics. *Am. J. Psychiat.* 109:674-676, 1953.

The merchandizing of alcohol as a beverage, even with taxes, seems to be profitable and will gradually increase if the figures for the last three years are any guide. It is a far cry from the clean, well lighted package store, with its well bottled shelves, from the glittering music-filled cafes and restaurants and even the average bar room to the terminal stages in hospital, home and hovel. The contrasts are obvious; the remedies are not. One widely heralded remedy, the great American experiment of prohibition, failed, human nature being what it is.

METROPOLITAN STUDIES MARRIAGE SURVIVAL

When Sheridan wrote his immortal toast that included the widow of fifty he did not miss by many years the truth of the matter as it exists today. For the inspired and indefatigable statisticians of the Metropolitan Life Insurance Company have discovered that fifty-six is the median age at which American wives currently enter widowhood.

According to these researches it now appears that about 660,000 marriages each year are interrupted by death, in two thirds of which the wife is the survivor. Fifty years ago, when husbands were tougher or wives more vulnerable, the odds were more nearly even.

Despite the greater chances of survival on the distaff side, accounted for by the reciprocal facts that women have a longer life expectancy than men and are usually younger than their husbands, the increased expectancy for both has resulted in a longer period of connubial bliss — or otherwise — than ever before. Widowhood is on the increase, but it takes the wife a longer time to attain it.

Widowhood has, moreover, a tenacious quality, for three quarters of the fifty-year-old widows will live another twenty years or more. The progression then goes on like the half lives of radioactive sub-

stances, for 50 per cent of women widowed at sixty-five can expect another fifteen years of life, and nearly a third of these, like those of fifty, will live for twenty years beyond the time of their bereavement.

"CARE" MEDICAL HELP TO INDIA

CARE (Cooperative for American Remittances Everywhere) and the World Health Organization of the United Nations have organized a program to provide aid for the hospitals in India. The need for supplies, equipment and instruments has been established by a thorough investigation by WHO, which mentions in detail the lack of instruments for major surgical procedures and operative deliveries, x-ray apparatus and medical books, all of which are needed in hospitals of the area to provide the basic medical care for patients. About eighty hospitals in India and twice that number in other countries of South East Asia have been suggested to CARE as being worthy of such medical aid.

A committee of physicians has been formed with Dr. Charles F. Wilinsky, former director of the Beth Israel Hospital and past president of both the American Hospital Association and the American Public Health Association, as chairman. Dr. Wilinsky pointed out at the first meeting of this committee in New York that almost $2,000,000 is needed to fill the minimum requirements of nearly 300 hospitals in South East Asia. The program received the earnest endorsement of the American Medical Association and its auxiliary and the American Hospital Association at their recent conventions, and CARE agreed to undertake the task of purchasing, shipping and delivering this material as it is made available.

The widespread poverty and disease in the areas that these hospitals serve can hardly be visualized by persons living in the rest of the world, and any help that is forthcoming will improve the medical care of the people in the afflicted areas.

An hydropathic school, it appears, has been organized in New York. Water, of course, is taught to be the invariable remedy of every disease.

Boston M. & S. J. *January 11, 1854*

PRIZE ESSAY COMPETITION

The $100 prize-essay competition for fourth-year students closes March 15, 1954.

Full details were published in the *Journal* of October 22.

MASSACHUSETTS MEDICAL SOCIETY

AMA MEMBERSHIP

Notice to fellows of the Massachusetts Medical Society who do not belong to the American Medical Association:

By vote of the House of Delegates of the American Medical Association at the St. Louis session in December, any physician who was an active member of the American Medical Association in 1950 and failed to pay dues for that year, thereby being suspended for his delinquency, may be reinstated during the first six months of 1954 by payment of 1954 dues only. This privilege will extend through July 1, 1954, only.

ROBERT W. BUCK, M.D., *Secretary*

DEATHS

CRANE — George E. Crane, M.D., of Haverhill, died on November 29. He was in his eighty-first year.

Dr. Crane received his degree from Massachusetts College of Physicians and Surgeons in 1913. He was formerly a member of the Haverhill Board of Health.

He is survived by a brother.

OLSON — Joseph Merrill Olson, M.D., of Westboro, died on December 22. He was in his fifty-second year.

Dr. Olson received his degree from Boston University School of Medicine in 1927, and was a fellow of the American Medical Association.

He is survived by a sister.

TRIPP — Edwin P. Tripp, M.D., of Falmouth, died on December 11. He was in his seventy-eighth year.

Dr. Tripp received his degree from Tufts College Medical School in 1910. He served as welfare-department physician and on the Board of Health in Falmouth.

He is survived by his widow, two sons, four brothers, two sisters and four grandchildren.

MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

MORTALITY AND MORBIDITY OF TETANUS IN MASSACHUSETTS, 1932–1952

A health department should take stock of the achievements of its programs as soon as significant data can be studied. Since 1949 the Biologic Laboratories have made available for general use in children the "triple vaccine" for immunization against pertussis, diphtheria and tetanus. Tetanus immunization was undoubtedly practiced by physicians and clinics some years before 1949, but the annual issue of over 100,000 doses of the triple vaccine for the last four years, equivalent to the number of children born annually in the Commonwealth of Massachusetts, indicates that it is now the practice to immunize the great majority of young children in the State with this preparation.

The cases reported to the Division of Communicable Diseases of the Department of Public Health for the last twenty-one years are given in Table 1. Although under-reporting may make the absolute figures less certain, information can be obtained from the relative decrease in the several age groups. Only two age groups have shown a significant decrease in tetanus morbidity: children 0 to 4 years of age have dropped since 1946 from 2 or 3 cases annually to none in 3 in consecutive years. Adults from 20 to 39 have also shown a significant decrease since 1943. In other age groups, there is some but not a statistically significant decrease among children 5 to 9 years old, and other ages — 10 to 19 and over 40 — have not shown a noteworthy decrease in morbidity.

The inference drawn is that immunization has had an effect up to 5 years of age, with a promise of decrease in morbidity in older children as the years go by. The decrease among persons 20 to 39 years of age is undoubtedly due to the large number of males of that age population who were immunized in the armed forces. Recent studies show that a majority of veterans have high immunity even ten years after the last toxoid injection.

The number of deaths reported has decreased even more in the last twenty years (Table 2). It is easy to realize that under-reporting of morbidity takes place since the number of deaths in the period 1932–1940 almost approached reported cases, even exceeding them by 1 in 1932–34. There has been

TABLE 1. *Reported Cases of Tetanus, by Age, Massachusetts, 1932–1952.*

YEAR	AGE 0–4 YR.	5–9 YR.	10–19 YR.	20–39 YR.	40–59 YR.	OVER 60 YR.	UNKNOWN	TOTALS
1932–34	5	12	13	14	11	3		58
1935–37	6	15	20	7	8	3		59
1938–40	10	12	9	11	6	8		56
1941–43	6	13	8	7	4	5	1	44
1944–46	4	11	11	2	6	8	1	43
1947	1	2	3	1	1	2		10
1948	0	3	3	1	1	1		9
1949	1	2	2	2	2	1	1	11
1950	0	1	3	1	1	3		9
1951	0	4	2	0	4	4		14
1952	0	1	3	2	1	2		9
Totals	33	76	77	48	45	40	3	322
Cases per 100,000 per year*	0.61	1.32	0.50	0.17	0.19	0.32		0.35

*1940 Census.

TABLE 2. *Deaths from Tetanus, by Age, Massachusetts 1932–1951.*

YEAR	AGE 0–4 YR.	5–9 YR.	10–19 YR.	20–39 YR.	40–59 YR.	OVER 60	TOTALS	MALES	FEMALES
1932–34	6	10	14	13	12	4	59	44	15
1935–37	6	8	14	5	10	5	48	34	14
1938–40	5	6	6	10	6	5	38	31	7
1941–43	2	3	5	3	2	2	17	13	4
1944–46	6	1	2	2	0	4	15	12	3
1947	0	0	0	1	0	0	1	0	1
1948	0	0	1	0	0	1	2	2	0
1949	0	0	0	0	0	0	0	0	0
1950	0	0	1	1	0	0	2	1	1
1951	0	1	0	0	1	2	4	1	3
Totals	25	29	43	35	31	23	186	138	48
Cases per 100,000 per year†	0.49	0.53	0.30	0.13	0.14	0.20	0.21	0.30	0.11
Case mortality†	76	38	56	73	69	58	58		

*Source: annual report of vital statistics of Massachusetts.

†1940 Census.

‡Percentages explained by under-reporting of cases.

a sharp decrease since 1930, for which the Department of Public Health has little claim to credit. Better surgical management of cases, chemotherapy and other modern features of medical care brought the annual deaths among persons 12 to 20 years of age in the 1930's down to 1 or 2. Five consecutive years are noted without deaths in young children.

One age group, comprising those over 60, has shown no decrease, and it is also noteworthy that deaths in females, which used to be less than a third of the male deaths, now equal them.

Tetanus is a rare but cruel disease. The incidence can be reduced to 0. Immunization of children and military personnel has shown the way. It can be applied to the total population, but the question is whether it is necessary to wait until the present child population is over 60 years of age. Each physician should make it a habit to give *all* his patients a few injections of the harmless toxoid.

JOHANNES IPSEN, JR., M.D.
Superintendent
Institute of Laboratories

NOTICES

BOSTON CITY HOSPITAL HAND SERVICE LECTURE

The Hand Service of the Boston City Hospital will present a lecture by Professor Patrick Clarkson, F.R.C.S., Guy's Hospital, London, on the subject "Plastic Contributions to Surgery of the Hand" in the Dowling Amphitheater of the Hospital on Monday, January 18, at 8 p.m.

BOSTON LYING-IN HOSPITAL JOURNAL CLUB

The Journal Club of the Boston Lying-in Hospital announces the following lectures, to be given in the auditorium, Boston Lying-in Hospital, on the dates specified, at 4 p.m.:

January 15. Pregnancy Tumors of the Mouth. Dr. Moses Strock.
January 29. X-ray Diagnosis of the Acute Abdomen. Dr. Richard Schatzki.
February 5. Prevention of Transfusion Reactions. Dr. Mark F. Lesses. Use of Blood and Cell Fractions in Complications of Obstetrics. Dr. James L. Tullis.
February 19. Studies of the Human Placenta with the Use of the Electron Microscope. Dr. George B. Wislocki.
March 12. To be announced. Dr. Hugh Grady.
March 26. Cancer of the Colon. Dr. Arthur W. Allen.
April 9. Anemias in Pregnancy. Dr. Maurice B. Strauss.
April 23. Liver Coma. Dr. Charles S. Davidson.
May 7. Radical Wertheim Hysterectomy for Cancer of the Uterus. Dr. Langdon Parsons.
May 21. To be announced. Dr. George Van S. Smith.

Coffee will be served at 3:45 p.m. All interested physicians and medical students are invited.

MIDDLESEX SOUTH DISTRICT MEDICAL SOCIETY

A meeting of the Middlesex South District Medical Society will be held in Jenkins Auditorium, Malden High School, Salem Street, Malden, on Wednesday, January 27, at 8 p.m. A business meeting will precede a panel discussion on the subject "Indigestion" by Drs. Charles G. Child, Harry Shwachman and F. Dennette Adams. All interested physicians are invited.

AMERICAN ACADEMY OF DENTAL MEDICINE

The eighth annual meeting of the American Academy of Dental Medicine will be held at the Penn Sheraton Hotel, Philadelphia, May 14 through 16, 1954. "Diagnosis and Treatment Planning" will be the theme of the scientific sessions. All members and interested physicians and dentists are invited. Programs and reservations may be obtained from the National Secretary, Dr. William M. Greenhut, 124 East 84th Street, New York 28, New York.

INTERNATIONAL ACADEMY OF PROCTOLOGY 1953-1954 AWARD CONTEST

The International Academy of Proctology will award $100 and a certificate of merit for the best unpublished contribution on proctology or allied subjects. The competition is open to all physicians in all countries. All entries, which should be limited to 5000 words, typewritten in English, submitted in five copies and received before February 1, 1954, should be addressed to the International Academy of Proctology, 43-55 Kissena Boulevard, Flushing, New York. The presentation of the prizes and certificates will be made at the annual convention dinner dance in April, 1954.

SOCIETY MEETINGS AND CONFERENCES

JANUARY 12. Harvard Medical Society. Page 1087, issue of December 24.

JANUARY 13. Boston Gastroenterological Society. Page 1044, issue of December 17.

JANUARY 13. E. Stanley Emery Memorial Lecture. Page 1130, issue of December 31.

JANUARY 15–MAY 21. Boston Lying-in Hospital Journal Club. Notice above.

JANUARY 15. New England Roentgen Ray Society and Boston Orthopedic Club. Page 1130, issue of December 31.

JANUARY 18, FEBRUARY 1 and 15, MARCH 1 and 15 and APRIL 5 and 19. Hartford Medical Society. Page 1130, issue of December 31.

JANUARY 18. Boston City Hospital Hand Service Lecture. Notice above.

JANUARY 19. South End Medical Club. Page 1088, issue of December 24.

JANUARY 22, 23, 29 and 30. International College of Surgeons Regional Meeting. Page 828, issue of November 12.

JANUARY 26. Massachusetts Hospital Association. Page 1130, issue of December 31.

JANUARY 27. Middlesex South District Medical Society. Notice above.

FEBRUARY 2–4. Examination for Public Health Service Medical Officers. Page 750, issue of October 29.

FEBRUARY 15–20. Pan-American Academy of General Practice. Page 790, issue of November 5.

FEBRUARY 23–25. College of Medical Evangelists Alumni Postgraduate Convention. Page 1044, issue of December 17.

MARCH 3 and APRIL 21. Massachusetts Society for Research in Psychiatry. Page 750, issue of October 29.

MARCH 15–26. Course in Laboratory Diagnosis of Virus Diseases. Page 1044, issue of December 17.

MARCH 27 and 28. American Psychosomatic Society. Page 1044, issue of December 17.

MAY 14–16. Fifth Annual International Group of Doctors in Alcoholics Anonymous. Page 1004, issue of December 10.

MAY 14–16. American Academy of Dental Medicine. Notice above.

MAY 31–JUNE 3. American Urological Association. Page xvii, issue of July 23.

JULY 22 and 23. International College of Surgeons Regional Meeting. Page 828, issue of November 12.

JULY 23–29. International Cancer Congress. Page 914, issue of November 26.

SEPTEMBER 7–10. Nineteenth Annual Congress of the United States and Canadian Sections of the International College of Surgeons. Page 828, issue of November 12.

SEPTEMBER 12–15. Second International Congress of Cardiology. Page 44, issue of July 2.

SEPTEMBER 16–18. American Heart Association Annual Scientific Sessions. Page 44, issue of July 2.

DISTRICT MEDICAL SOCIETIES

ESSEX NORTH

JANUARY 13. Pentucket Club, 111 Main Street, Haverhill.
MAY 12. 113th Annual Meeting. Andover Country Club, Andover.

MIDDLESEX EAST

JANUARY 20. Combined with the Auxiliary.
MARCH 24.
MAY 11. Annual Meeting. (Harlow Dinner.)

MIDDLESEX SOUTH

JANUARY 27. Jenkins Auditorium, Malden High School, Salem Street, Malden. 8:00 p.m.

CALENDAR OF BOSTON DISTRICT FOR THE WEEK BEGINNING THURSDAY, JANUARY 14

THURSDAY, JANUARY 14

*8:00–8:45 a.m. Case Presentations. Joslin Clinic. Joslin Auditorium, New England Deaconess Hospital.

(Notices concluded on page xxv)